AVANTEK

1986 MODULAR PRODUCT DATA BOOK

1986

Modular Product Data Book

About The Cover

Vertical Integration: Avantek manufactures all critical components for all of its products beginning with its own silicon and GaAs microwave transistors and MMICs. They are used in Avantek modular component products and Avantek's integrated systems and sub-assemblies. Complete control at every step assures the highest quality, reliability and repeatability.

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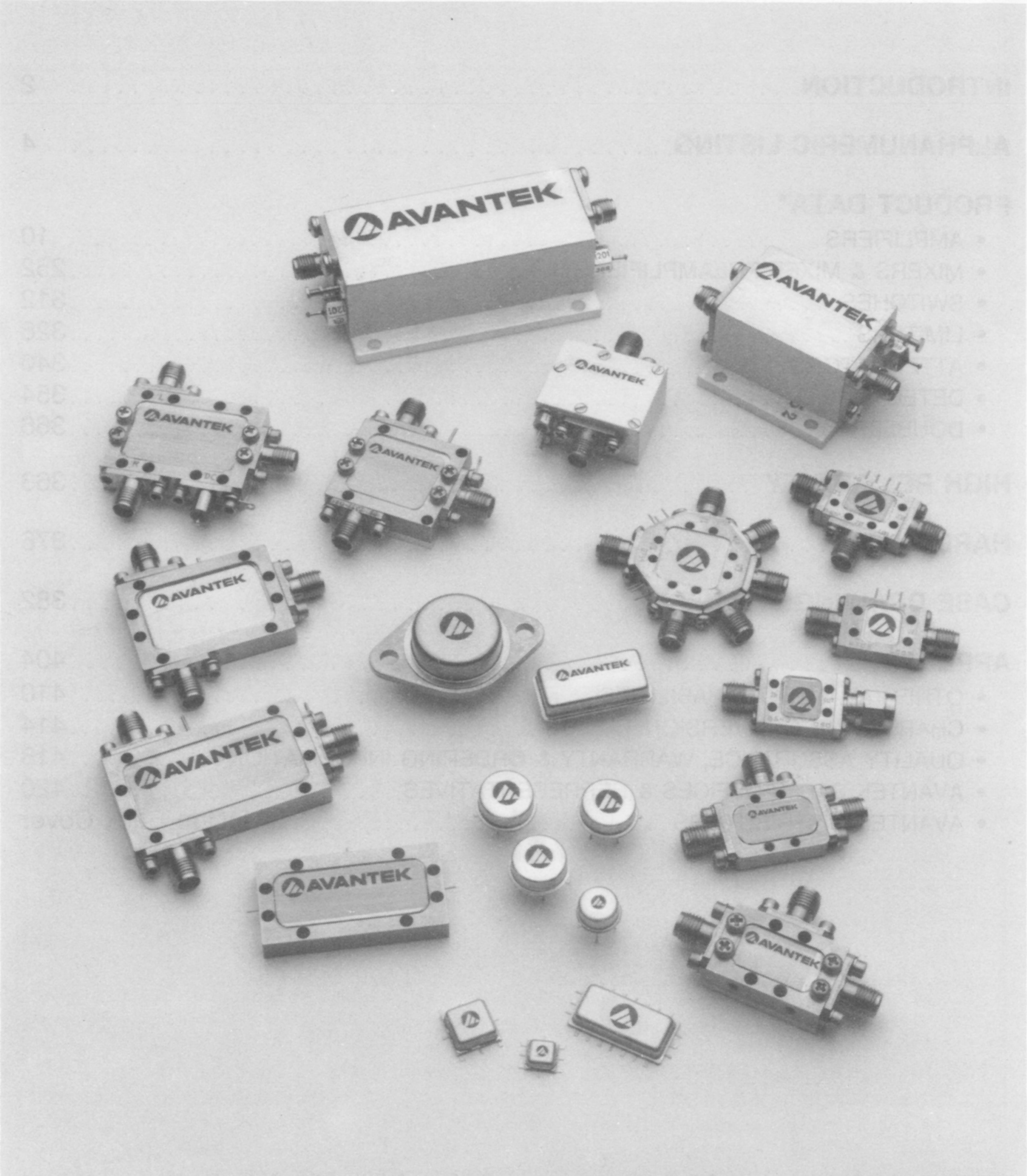
INTRODUCTION



• Modular Components

MODULAR COMPONENTS

Avantek's Modular Components and Subassemblies Division offers a wide range of RF and microwave components to meet our customer's needs for cost effective high performance products. Drawing on Avantek's state-of-the-art silicon and gallium arsenide semiconductor capabilities, the Modular Components and Subassemblies Division maintains expert staffs of design, manufacturing, test and quality personnel whose goal is to provide our customers with an ever increasing range of high performance RF and microwave components. Our people are supported with the best equipment available throughout the entire development/manufacturing/test process. Computer aided design, engineering, drafting and manufacturing play a significant and ever increasing role in the production of our products, and our high volume automated production and test capabilities are constantly being upgraded.

Modular components offer the system designer a cost effective "building block" approach which usually saves both time and money, and yields improved system performance. Consider some of the "Modular benefits:"

- design cost savings
- greatly reduced system development time
- state-of-the-art, off-the-shelf system building blocks
- simplified system troubleshooting and repair
- full time, ongoing product development and support from the Avantek Modular Team

MODULAR FUNCTIONS[1]

Avantek Modular Components cover frequency ranges from DC to 18 GHz, and are designed to operate in conventional 50-ohm systems as stand-alone functions or in combination with other functions.

Modular products include Amplifiers, AGC Amplifiers, Limiting Amplifiers, Mixers, Mixer-Preamplifiers, Switches, Attenuators, Limiters and Detectors. The selection guides throughout this catalog are provided to offer the user a convenient overview of the Avantek products offered in each catagory and to provide sufficient technical information about each product to aid in proper selection and location of the relavent data page.

MODULAR PACKAGE OPTIONS

In addition to the wide range of performance offered by the Modular Products Family, a variety of package options are also available to meet size, weight and design requirements. Package options available are:

- TO-8 and TO-12 hermetic metal can
- PlanarPak™ miniature hermetic surface mount
- Avanpak™ hermetic connectored or connectorless
- UTC Cascade

The TO and PlanarPak™ cases offer the smallest size, with the TO being suitable for through-hole softboard applications and the PlanarPak™ providing state-of-the-art component technology for either softboard or ceramic substrate surface mount applications. The Avanpak™ package is ideal for either connectored or connectorless applications where premium performance and small size are essential. The UTC Cascade offers one to four of the TO modular products in a connectored, sealed aluminum case.

Where possible, throughout this catalog, products which are available in different package options are listed on the same catalog page as a series. The different packages in which the particular product is available is indicated by the relevent case photos on each data sheet. Detailed dimensional drawings of all Avantek modular packages can be found in the Case Drawings section of this catalog.

Note 1: Avantek's Modular Products and Subassemblies Division does not manufacture oscillator products. Should the reader have a need for signal source functions, a wide range of oscillator products are available from Avantek's Oscillator and Signal Processing Division and that division's catalog should be consulted.

HOW TO USE THE DATABOOK SERIES

The Avantek Databook set consists of the following items:

1. Product Guide
2. Amplifier Databook*
3. Modular Databook
4. Signal Sources and Filters Databook
5. Semiconductor Databook
6. Subassemblies Capabilities Brochure

Item 1, the Product Guide, gives summary specifications for all of Avantek's standard products at time of publication. Custom and special products are described. It is suggested that this Product Guide be used as the first reference to locate products of possible use. When potentially useful products have been identified, the user should refer to items 2 through 6, the Databooks, which provide complete, detailed data sheets on all standard Avantek products in that category plus application notes and other appropriate information. Some products, such as modular amplifiers, may appear in more than one databook for user convenience.

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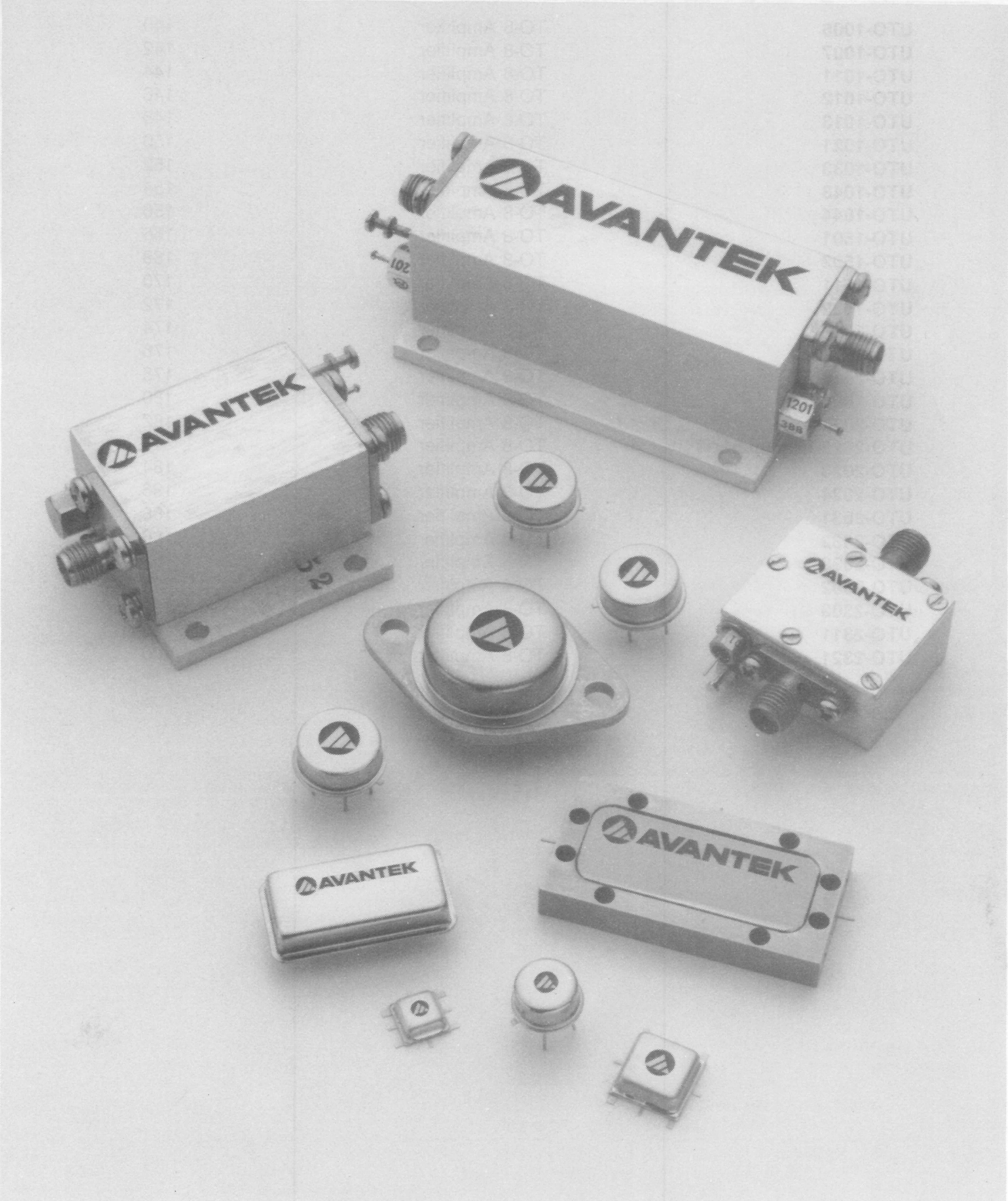
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Product Descriptions

GPD TO-12 AMPLIFIERS

The GPD TO-12 Amplifiers are low cost, small size general purpose amplifier modules which cover the 5 to 1000 MHz frequency range. Noise figures are as low as 3.2 dB, gains are as high as 33 dB and output power is up to +20 dBm @ 1 dB gain compression over 0 to 50°C case temperature.

Two types of GPD's are available: (1) the standard model which is equipped with internal coupling and bypass capacitors, and (2) the 60 Series which is used with external user-supplied coupling and bypass capacitors to allow the low frequency roll-off to be set as low as required.

The GPD Series was specifically designed for amplifier applications which require compactness and a high performance-to-cost ratio.

GPD amplifiers are supplied in the TO-12 metal/glass hermetic package.

PLANARPAK™ SURFACE MOUNT AMPLIFIERS

These devices are RF amplifiers designed into surface mount microwave component packages.

The PlanarPak package allows the use of simpler microstrip installations at higher densities with improved performance. The package is built around an alumina or beryllia substrate on which the thin-film circuit is directly fabricated. RF and DC connections are made through the substrate via plated through-holes. The leads are attached to the substrate over the through-holes by reflow brazing which hermetically seals them.

PlanarPak amplifiers cover the 5 MHz to 18 GHz frequency range. Noise figures are as low as 2.0 dB, gains as high as 29 dB and output power up to +20 dBm @ 1 dB gain compression over 0 to 50°C case temperature.

HIGH PERFORMANCE UTO AMPLIFIERS

UTO Amplifiers are high performance cascadable amplifier modules that have been specifically designed to provide very stable and repeatable performance under the most difficult operating conditions.

The UTO Series covers the 1 to 2300 MHz frequency range. Noise figures are as low as 2.0 dB, gains as high as 30 dB and output power up to +26 dBm @ 1 dB gain compression over 0 to 50°C case temperature.

UTO Amplifiers are supplied in the TO-8 metal/glass hermetic package.

HIGH PERFORMANCE UTC AMPLIFIERS

The UTC Series of high performance cascadable amplifier modules offers similar specification, performance and reliability features of the UTO amplifiers but in a different package.

This series is offered in the new TC-1 sealed aluminum case with RFI-filtered DC feedthroughs and factory installed SMA connectors.

AGC VOLTAGE-CONTROLLED AMPLIFIERS

The AGC Series combines a thin-film cascadable amplifier with a fast response attenuator over a 5 to 1000 MHz frequency range.

Each model is a complete AGC amplifier in a single package, and when combined with other amplifier modules produces a voltage-controlled amplifier.

The AGC-553 and 1053 models are built with cascaded silicon monolithic integratged circuit amplifiers to provide the highest density AGC function available.

The AGC-330 is supplied in the TO-3 case and the AGC-553 and 1053 are available in the TO-8 package.

CASCADED AMPLIFIERS

ACT Series—The ACT Series of amplifiers consists of one, two or three stages of UTO amplifiers cascaded within the Avanpak miniature flatpack.

Each stage of the ACT Series can be tuned for maximum performance and efficient matching with the next unit.

The ACT Series, with a frequency range of 10 to 2000 MHz, is recommended for use where either small size, premium performance, or microstrip compatibility is required.

UTC Series—The UTC Series of amplifiers contains one to four cascaded products from any of several of Avantek's Modular Amplifier product lines.

This UTC Series is supplied in sealed aluminum TC 2 or TC 4 cases with RFI-filtered DC feedthroughs and SMA connectors that are factory installed.

The frequency range of the UTC cascaded amplifiers is 10 to 2000 MHz.

LIMITING AMPLIFIERS

Avantek's thin-film limiting amplifiers have been designed with flat power output, low phase shift variation and high even harmonic suppression. They cover the frequency range of 5 to 1000 MHz and an input power limiting range of –33 to +10 dBm.

The basic UTL model consists of a thin-film hybrid differential amplifier supplied in a TO-8 case.

The UDL model is designed with three amplifier modules cascaded in a dual-in-line (DIP) package.

The PlanarPak model, the PPL-504, covers 10 to 1000 MHz and has a compression range of up to 55 dB. It is provided in the newly designed surface mount package which allows the use of simpler microstrip installation at higher densities with improved performance.

Applications include removing amplitude modulation from FM signals and preventing the overdriving of detection circuits. They also can be used as pulse amplifiers with pulse recovery time of less than 2 nanoseconds.

Selection Guide

GPD TO-12 Amplifiers (Guaranteed Specifications @ 0° to 50°C Case Temperature)

Model	Frequency Range (MHz) Minimum	Gain (dB) Minimum	Noise Figure (dB) Typical	Power Output for 1 dB Gain Compression (dBm) Typical	Gain Flatness (±dB) Typical	3rd Order Intercept Point (dBm) Typical	Input Power (±1% Reg.) Voltage (VDC)	Input Power (±1% Reg.) Current (mA) Typical	Page No.
GPD-201	5–200	30	3.5	+5	1.0	+13	+15	30	18
GPD-202	5–200	25	5.5	+9	1.0	+14	+15	60	20
GPM-552	5–500	33	4.5	0	0.2	+14	+15	34	40
GPM-1052	5–1000	20	7.0	+8	0.3	+20	+15	60	48
GPD-251	5–200	25	4.0	+1	1.0	+10	+5	30	22
GPD-252	5–200	15	4.0	0	1.0	+12	+5	11	24
GPD-401/461[1]	5–400	13	4.5	−2	1.0	+5	+15	10	28
GPD-411	5–400	12	3.2	−6	1.0	+4	+15	7	38
GPD-402/462[1]	5–400	13	6.0	+6	1.0	+18	+15	24	30
GPD-403/463[1]	5–400	9	7.5	+15	1.0	+25	+24	65	32
GPD-404/464[1]	5–400	9	7.5	+15	1.0	+26	+15	70	34
GPD-405	10–400	13	6.5	+20	1.0	+29	+15	60	36
GPD-1001/1061[1]	5–1000	12	6.0	0	1.0	+12	+15	15	42
GPD-1002/1062[1]	5–1000	12	7.0	+6	1.0	+16	+15	27	44
GPD-1003/1063[1]	5–1000	10	8.0	+14	1.0	+24	+15	55	46

Note 1: The 60 Series is the same as the standard series except that three external capacitors are required to establish low frequency roll-off.

PlanarPak™ Surface Mount Amplifiers (Guaranteed Specifications @ 0° to 50°C Case Temperature)

Model	Frequency Range (MHz) Minimum	Gain (dB) Minimum	Noise Figure (dB) Maximum	Power Output at 1 dB Gain Compression (dBm) Minimum	Power Requirements Voltage (VDC)	Power Requirements Current (mA) Nominal	Page No.
PPA-210	10–200	8.0	2.0	+11	+15	15	50
PPA-211	10–200	7.5	2.7	+17	+15	30	52
PPA-253	5–200	29.0	4.0	0	+5	30	26
PPA-543	10–500	10.0	2.5	+6	+15	25	118
PPA-544[1]	10–500	10.0	3.0	+12	+15	35	120
PPA-519	5–500	13.0	5.5	+13	+15	70	106
PPA-509	5–500	13.0	5.5	+20	+15	90	86
PPA-520	5–500	14.0	4.5	+12	+5	33	108
PPA-1043(P)[1]	10–1000	10.0	4.0	+6	+15	25	154
PPA-1044(P)[1]	10–1000	10.0	4.5	+10	+15	35	156
PPA-1005	5–1000	11.0	6.0	+20	+15	90	138
PPA-1006	5–1000	11.0	6.0	+17	+15	70	140
PPA-1007	5–1000	12.5	5.0	+11	+5	33	142
PPA-2012[2]	500–2000	9.0	4.0	+12	+15	50	176
PPA-2013[2]	500–2000	9.0	5.5	+19	+15	100	178
PPA-4132	1000–4000	20.0	6.0	+17	+8	150	202
PPA-6232(P)	2000–6000	17.0	6.0	+17	+8	150	204
PPA-18232(P)	2000–18000	9.0	9.5	+11	+8	155	206

(P) Preliminary

Notes 1: Both RF input and RF output pins are at DC ground. No blocking capacitor.

2: RF input pin is at DC ground. No input blocking capacitor.

Selection Guide

High Performance UTO Amplifiers (Guaranteed Specifications @ 0° to 50°C Case Temperature)

Model	Frequency Range (MHz) Minimum	Gain (dB) Minimum	Noise Figure (dB) Maximum	Power Output for 1 dB Gain Compression (dBm) Minimum	Gain Flatness (±dB) Maximum	3rd Order Intercept Point (dBm) Typical	Input Power (±1% Reg.)		Page No.
							Voltage (VDC)	Current (mA) Typical	
10 to 200 MHz	(Listed in order of Increasing Noise Figure, Increasing Power Output)								
UTO-514	30–200	15	2.0	−3	0.75	+7	+15	8	96
UTO-210	10-200	8.0	2.0	+11	1.0	+29	+15	15	50
UTO-221	10–200	27	2.5	+13.5	0.7	+27	+15	29	54
UTO-211	10-200	7.5	2.7	+17	1.0	+28	+15	30	52
UTO-222	20–200	28	3.5	+19	0.7	+32	+15	47	56
UTO-250	5–200	30	4.0	−3	1.0	+9	+5	13	58
5 to 400 MHz									
UTO-443[3]	10–400	12.5	4.5	+4.5	0.7	+19	+5	10	72
UTO-440[3]	10–400	12.5	4.5	+8	0.7	+23	+15	15	66
UTO-441[3]	20–400	13.5	4.5	+15	0.7	+32	+15	32	68
UTO-444[3]	10-400	12.5	5.0	+8	0.7	+22	+5	15	74
UTO-421	5–400	27	5.5	+6	1.0	+18	+15	38	64
UTO-410	5–400	15	3.0	−2	1.0	+8	+15	10	60
UTO-416	5–400	14	5.5	+10	1.0	+23	+15	35	62
UTO-442[3]	10–400	13	5.5	+20	0.7	+33	+15	62	70
2 to 500 MHz									
UTO-511	5–500	15	2.5	−2	1.0	+8	+15	10	90
UTO-517	5-500	22	2.5	+5	1.0	+15	+15	22	102
UTO-543[1]	10–500	10	2.5	+6	1.0	+22	+15	25	118
UTO-510	5–500	15	3.0	−2	1.0	+8	+15	10	88
UTO-512	5-500	20	3.0	+7	1.0	+20	+15	23	92
UTO-544[1]	10–500	10	3.0	+12	1.0	+28	+15	35	120
UTO-572[4]	50–500	18	3.5	+11	0.5	+24	+15	32	130
UTO-501	5–500	14	4.0	−2	1.0	+11	+15	10	76
UTO-521	5-500	27	4.0	+8	1.0	+18	+15	38	110
UTO-502	5-500	14	4.0	+7	1.0	+21	+15	23	78
UTO-571[4]	50–500	14.5	4.0	+10	0.5	+27	+15	32	128
UTO-524	5–500	30	4.0	+14	1.0	+27	+15	70	114
UTO-516	5-500	14	4.5	+10	1.0	+23	+15	35	100
UTO-520	5–500	14	4.5	+12	0.7	+22	+5	33	108
UTO-533	5–500	16	5.0	+14	0.7	+30	+15	53	116
UTO-545	10-500	10	5.0	+17	0.5	+36	+15	60	122
UTO-519	5–500	13	5.5	+18	0.7	+33	+15	70	106
UTO-509	5–500	13	5.5	+20	1.0	+35	+15	90	86
UTO-513	5–500	16	6.0	+14	1.0	+31	+24	50	94
UTO-518	5–500	13	6.0	+23	0.7	+38	+15	130	104
UTO-523	5–500	23	7.0	+12	1.0	+25	+15	80	112
UTO-503	5–500	9	7.0	+13	1.0	+33	+24	50	80
UTO-515	2–500	12	7.0	+14	0.5	+28	+15	65	98
UTO-505	10-500	9	7.0	+18	1.0	+33	+15	95	84
UTO-546[3]	10–500	10	8.0	+23	0.5	+38	+15	110	124
UTO-561[2]	10–500	11	9.0	+26	0.7	+39	+15	190	126
UTO-504	5–500	6	11.0	+17	1.0	+34	+24	100	82
2 to 1000 MHz									
UTO-1011	2–1000	14	3.5	−5	0.7	+10	+15	8	144
UTO-1012	5–1000	15	4.0	+4	1.0	+17	+15	18	146
UTO-1043[1]	10–1000	10	4.0	+6	1.0	+22	+15	25	154
UTO-1013	5–1000	15	4.5	+9	1.0	+20	+15	29	148
UTO-1044[1]	10–1000	10	4.5	+12	1.0	+28	+15	35	156
UTO-1021	5–1000	22	4.5	+12	1.0	+27	+15	85	150
UTO-1001	5–1000	14	5.0	−2	1.0	+11	+15	10	132
UTO-1007	5–1000	12.5	5.0	+11	0.7	+21	+5	33	142
UTO-1006	5–1000	11	6.0	+17	1.0	+30	+15	70	140
UTO-1005	5–1000	11	6.0	+20	1.0	+33	+15	90	138
UTO-1002	5–1000	14	6.5	+7	1.0	+21	+15	23	134
UTM-1056	10–1000	25.6	6.5	+12	0.7	+20	+15	135	162
UTM-1057	10–1000	26	6.5	+14	0.7	+29	+15	170	164
UTO-1033	5-1000	10	6.5	+14	1.0	+28	+15	48	152
UTM-1055	10–1000	15.5	7.5	+15	0.7	+29	+15	135	160
UTM-1053	5–1000	27	9.0	+5	2.0	+21	+15	90	158
UTO-1004	10–1000	6	12.0	+20	0.7	+40	+15	110	136

Selection Guide

High Performance UTO Amplifiers (continued) (Guaranteed Specifications @ 0° to 50°C Case Temperature)

Model	Frequency Range (MHz) Minimum	Gain (dB) Minimum	Noise Figure (dB) Maximum	Power Output for 1 dB Gain Compression (dBm) Minimum	Gain Flatness (± dB) Maximum	3rd Order Intercept Point (dBm) Typical	Input Power (± 1% Reg.) Voltage (VDC)	Input Power (± 1% Reg.) Current (mA) Typical	Page No.
5 to 1500 MHz									
UTO-1524	10–1500	21	4.5	+7	1.5	+19	+15	60	174
UTO-1511	5–1500	10	4.5	−9	0.5	+1	+15	7	170
UTO-1522	5–1500	18	5.5	+11	1.5	+23	+15	85	172
UTO-1501	5–1500	9	5.5	−3	0.5	+10	+15	10	166
UTO-1502	5–1500	9	7.5	+6	0.5	+19	+15	23	168
1 to 2000 MHz									
UTO-2031	1–2000	9	5.5	+2	1.0	+14	+15	16	188
UTO-2032	1–2000	9	6.0	+7	1.0	+17	+15	25	190
UTO-2033	1–2000	8	8.5	+14	1.0	+30	+15	50	192
10 to 2000 MHz									
UTO-2021	10-2000	9	4.0	+2	1.0	+14	+15	16	180
UTO-2012[2]	500–2000	9	4.0	+12	1.0	+23	+15	50	176
UTO-2024	5–2000	15	5.5	+5	1.0	+18	+15	38	186
UTO-2013[2]	500–2000	9	5.5	+19	1.0	+33	+15	100	178
UTO-2022	10–2000	9	6.0	+7	1.0	+17	+15	25	182
UTO-2025	100-2000	9.5	4.5	+25	1.0	+37	+15	175	—
UTO-2023	10-2000	8	8.5	+14	1.0	+29	+15	50	184
1700 to 2300 MHz									
UTO-2311	1700–2300	8	5.0	−3	0.5	+10	+15	15	198
UTO-2302	1700–2300	8	6,5	+3	0.5	+13	+15	18	194
UTO-2303	1700–2300	8	8.0	+10	0.5	+20	+15	30	196
UTO-2321	1700–2300	14	8.0	+10	1.0	+23	+15	70	200

Notes 1: Both RF input and RF output pins are at DC ground—no blocking capacitor.
2: RF input pin is at DC ground—no input blocking capacitor.
3: A portion of any DC voltage applied to the RF input pin will appear at the RF output pin (i.e., a resistive DC path exists between pins). There is no input or output blocking capacitor.
4: High reverse isolation. Typ S_{12} = −48 dB at 500 MHz.

+5 Volt Bias Amplifiers (Guaranteed Specifications at 0-50°C Case Temperature)

Model	Frequency (MHz) Minimum	Gain (dB) Minimum	Noise Figure (dB) Maximum	Power Output at 1 dB Compresssion (dBm) Minimum	VSWR	Current (mA) Typical	Page No.
UTO-443	10–400	12.5	4.5	+4.5	2.0:1	10	72
UTO-444	10–400	12.5	5.0	+8.0	2.0:1	15	74
UTO-250	5–200	30.0	4.0	−3	2.0:1	13	58
UTO-520	5–500	14.0	4.5	+12	2.0:1	33	108
UTO-1007	5–1000	12.5	5.0	+11	2.0:1	33	142

+15 Volt Bias Amplifiers Operated at +5 Volts (Typical Performance at 25°C Case Temperature)

Model	Frequency (MHz) Minimum	Gain (dB) Minimum	Noise Figure (dB) Maximum	Power Output at 1 dB Compression (dBm) Minimum	VSWR	Current (mA) Typical	Page No.
UTO-505	10–500	9.0	4.5	+10	<2.0:1	25	84
UTO-561	10–500	12.0	4.5	+13	<2.0:1	45	126
UTO-1021	5–1000	21.0	3.2	+3	<2.0:1	30	150
UTO-1033	5–1000	9.0	5.0	+5	<2.0:1	15	152
UTO-545	10–500	9.0	3.5	+5	<2.0:1	15	122

Selection Guide

ACT Series — Cascaded Amplifiers (Guaranteed Specifications @ 0° to 50°C, V = +15 VDC)

Model	Frequency Range MHz	Gain (dB) Typ./Min.	Noise Figure (dB) Max.	Power Output for 1 dB Gain Compression (dBm) Min.	Gain Flatness (±dB) Max.	3rd Order Intercept Point (dBm) Typ.	VSWR 50 ohms In/Out Maximum	Input Bias Current (mA) Typical	Page No.
10-500 MHz									
ACT5-200	10–500	26.5/25	2.7	+6	±1.5	+22	2.0:1	35	208
ACT5-201	10–500	37/35	2.7	+7	±1.5	+20	2.0:1	33	208
ACT5-202	10–500	51.5/49	2.7	+6	±1.5	+18	2.0:1	60	208
ACT5-203	10–500	64.5/62	2.7	+6	±2.0	+18	2.0:1	70	208
ACT5-210	10–500	27.5/26	3.0	+14	±1.5	+30	2.0:1	78	208
ACT5-211	10–500	38/36	3.5	+14	±1.5	+30	2.0:1	76	208
ACT5-212	10–500	47/45	2.7	+14	±1.5	+27	2.0:1	80	208
ACT5-213	10–500	54/52	2.7	+14	±2.0	+2.7	2.0:1	92	208
ACT5-214	10–500	67/65	2.7	+14	±2.0	−27	2.0:1	103	208
ACT5-220	10–500	24.5/23	3.5	+23	±1.5	+35	2.0:1	165	208
ACT5-221	10–500	35/33	3.0	+23	±2.0	+35	2.0:1	190	208
ACT5-222	10–500	46/44	3.0	+23	±2.0	+35	2.0:1	193	208
ACT5-223	10–500	60.5/58	3.0	+23	±2.0	+35	2.0:1	210	208
10-1000 MHz									
ACT10-210	10–1000	21.5/20	4.5	+11	±2.0	+28	2.0:1	60	208
ACT10-211	10–1000	31/29	3.7	+9	±1.5	+20	2.0:1	37	208
ACT10-212	10–1000	41/39	3.7	+9	±2.0	+27	2.0:1	62	208
ACT10-213	10–1000	52/50	3.7	+12	±2.0	+27	2.0:1	101	208
ACT10-220	10–1000	22.5/21	5.0	+20	±1.5	+35	2.0:1	125	208
ACT10-221	10–1000	33/31	4.5	+20	±2.0	+35	2.0:1	150	208
ACT10-222	10–1000	42/40	3.7	+20	±2.0	+35	2.0:1	127	208
ACT10-223	10–1000	49/47	3.7	+20	±2.0	+35	2.0:1	163	208
10-2000 MHz									
ACT20-210	10–2000	19.5/18	5.0	+7	±1.5	+17	2.2:1	41	208
ACT20-211	10–2000	28/26	5.0	+14	±2.0	+29	2.2:1	91	208
ACT20-212	10–2000	34/32	6.0	+14	±2.0	+29	2.2:1	104	208
ACT20-213	10–2000	40/38	6.0	+12	±2.0	+29	2.2:1	126	208

UTC Series — Cascaded Amplifiers (Guaranteed Specifications @ 0° to 50°C, V = +15 VDC)

Model	Frequency Range MHz	Gain (dB) Typ./Min.	Noise Figure (dB) Max.	Power Output for 1 dB Gain Compression (dBm) Min.	Gain Flatness (±dB) Max.	3rd Order Intercept Point (dBm) Typ.	VSWR 50 ohms In/Out Maximum	Input Bias Current (mA) Typical	Page No.
10-500 MHz									
UTC5-200	10–500	26.5/25	2.7	+6	±1.5	+22	2.0:1	35	210
UTC5-201	10–500	37/35	2.7	+7	±1.5	+20	2.0:1	33	210
UTC5-202	10–500	51.5/48	2.7	+6	±1.5	+18	2.0:1	60	210
UTC5-203	10–500	64.5/62	2.7	+6	±2.0	+18	2.0:1	70	210
UTC5-210	10–500	27.5/26	3.0	+14	±1.5	+30	2.0:1	78	210
UTC5-211	10–500	38/36	3.5	+14	±1.5	+30	2.0:1	76	210
UTC5-212	10–500	47/45	2.7	+14	±1.5	+27	2.0:1	80	210
UTC5-213	10–500	54/52	2.7	+14	±2.0	+2.7	2.0:1	92	210
UTC5-214	10–500	67/65	2.7	+14	±2.0	−27	2.0:1	103	210
UTC5-220	10–500	24.5/23	3.5	+23	±1.5	+35	2.0:1	165	210
UTC5-221	10–500	35/33	3.0	+23	±2.0	+35	2.0:1	190	210
UTC5-222	10–500	46/44	3.0	+23	±2.0	+35	2.0:1	193	210
UTC5-223	10–500	60.5/58	3.0	+23	±2.0	+35	2.0:1	210	210
10-1000 MHz									
UTC10-210	10–1000	21.5/20	4.5	+11	±2.0	+28	2.0:1	60	210
UTC10-211	10–1000	31/29	3.7	+9	±1.5	+20	2.0:1	37	210
UTC10-212	10–1000	41/39	3.7	+9	±2.0	+27	2.0:1	62	210
UTC10-213	10–1000	52/50	3.7	+12	±2.0	+27	2.0:1	101	210
UTC10-220	10–1000	22.5/21	5.0	+20	±1.5	+35	2.0:1	125	210
UTC10-221	10–1000	33/31	4.5	+20	±2.0	+35	2.0:1	150	210
UTC10-222	10–1000	42/40	3.7	+20	±2.0	+35	2.0:1	127	210
UTC10-223	10–1000	49/47	3.7	+20	±2.0	+35	2.0:1	163	210
10-2000 MHz									
UTC20-210	10–2000	19.5/18	5.0	+7	±1.5	+17	2.2:1	41	210
UTC20-211	10–2000	28/26	5.0	+14	±2.0	+29	2.2:1	91	210
UTC20-212	10–2000	34/32	6.0	+14	±2.0	+29	2.2:1	104	210
UTC20-213	10–2000	40/38	6.0	+12	±2.0	+29	2.2:1	126	210

Selection Guide

AGC Voltage-Controlled Amplifiers (Guaranteed Specifications @ 0° to 50°C Case Temperature)

Model	Frequency Range (MHz)	Gain (dB) Typ./Min.	AGC Range (dB) Typ.	AGC Voltage Range (Volts)	AGC Current Range (mA)	Maximum[1] Noise Figure (dB) Typ./Max.	Power Output at 1 dB Gain Compression (dBm) Minimum	Typical Range Time (μsec)	Bias Voltage (VDC)	Bias Current (mA)	Typical VSWR	Page No.
AGC-330	5–300	22/20	36	0 to 5	0 to 30	4.0/5.0	0	1.5	+15	25	<2.0	212
AGC-553	10–500	44/40	45	0 to 5	0 to 12	6.0/8.0	−4	25	+15	50	<2.0	214
AGC-1053	10–1000	22/18	35	0 to 5	0 to 12	11.0/12.0	+5	25	+15	90	<2.0	218

Notes 1: At 0 AGC.

Thin-Film Limiting Amplifiers (Guaranteed Specifications @ 0° to 50°C Case Temperature)

Model	Frequency Range (MHz)	Input Power Limiting Range (dBm) Minimum	Saturated Output Power (dBm) Minimum	Output Power Flatness (dB) Maximum	Noise Figure (dB) Maximum	Operating Bias (Vdc)	Page No.
UTL-502	5–500	−10 to +7	−4.0	±0.5	11.0	+15, −15	226
UTL-503(P)	5-500	−11 to +7	−4.0	±1.0	10.0	+15	228
UDL-502	5–500	−33 to +7	−4.0	±0.5	11.0	+15, −15	222
UDL-503	5–500	−33 to +10	−2.0	±1.0	10.0	+15	224
PPL-504	10–1000	−25 to +10	−4.0	±0.8	10.0	+15	230

(P) Preliminary

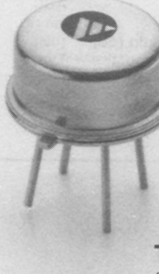
GPD-201

Thin Film Cascadable Amplifier Module
5-200 MHz

AVANTEK

FEATURES

- **High Gain: 33 dB (Typ)**
- **Low Noise: 3 dB (Typ)**
- **Low Cost**
- **Small Size**



TO-12 Case
(p. 403)

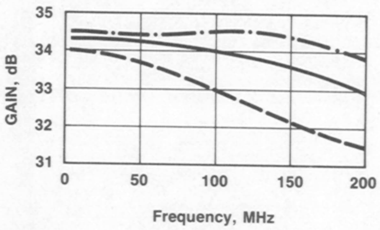
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	5-200	5-200	5-200	MHz
GP	Small Signal Gain	33.0	30.0 Min.	26.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	3.0	—	—	dB
—	Reverse Isolation	28.0			dB
$P_{1 dB}$	Power Output @ + 1 dB Compression	+5.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+13.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+16.0	—	—	dBm
I_D	DC Current	30		—	mA

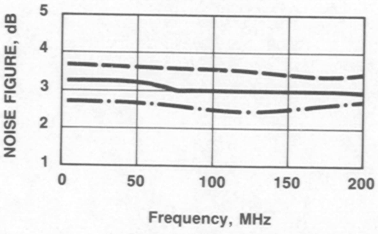
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

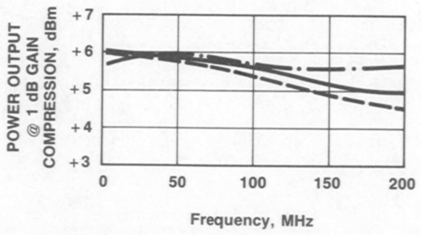
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

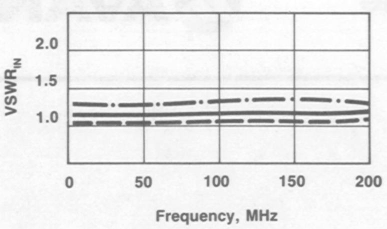
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

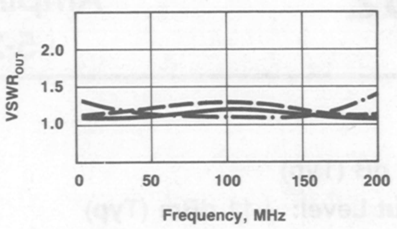
THERMAL CHARACTERISTICS*

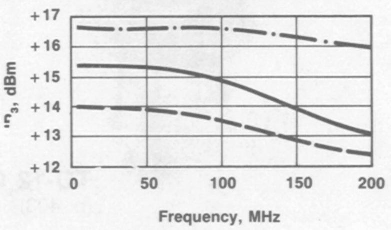
θ_{JC}	160°C/W
Active Transistor Power Dissipation	31.5 mW
Junction Temperature Above Case Temperature	5°C
MTBF	1,678,671 Hrs.

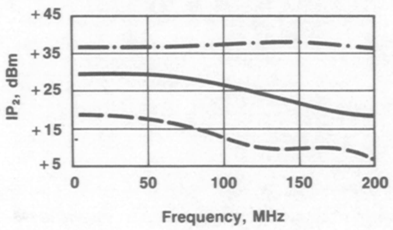
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams


Input VSWR


Output VSWR


Third-Order Intercept Point


Second-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.22	34.08	– 21.48	.03	.00	1.38	45.05
150.0	1.24	33.63	– 31.73	– .07	.56	1.35	42.53
200.0	1.30	33.06	– 41.78	.03	.55	1.35	45.17
250.0	1.33	32.23	– 51.68		.52	1.35	44.14
300.0	1.39	31.33	– 60.39		.46	1.37	45.09
350.0	1.42	30.34	– 68.41		.40	1.41	42.90
400.0	1.46	29.22	– 74.90		.33	1.46	45.16
450.0	1.49	28.20	– 80.20		.28	1.51	42.67
500.0	1.51	27.05	– 84.95		.21	1.55	42.98
550.0	1.54	25.98	– 87.93		.18	1.59	43.16
600.0	1.56	25.02	– 91.38		.15	1.61	42.20
650.0	1.57	23.93	– 93.28		.08	1.64	41.70
700.0	1.59	23.01	– 94.07		.05	1.66	40.94
750.0	1.60	22.13	– 94.91		.04	1.68	40.52
800.0	1.60	21.25	– 95.71		10.00	1.70	39.81
850.0	1.61	20.29	– 95.07		10.00	1.72	39.82
900.0	1.63	19.46	– 95.56		.02	1.71	39.45
950.0	1.64	18.64	– 95.69		9.95	1.73	38.96
1000.0	1.64	17.93	– 93.75		9.96	1.75	38.51

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.089	– 160.6	34.037	– 21.5	– 42.671	20.2	.172	– .6
150.00	.105	– 151.2	33.599	– 31.7	– 45.997	38.9	.153	.8
200.00	.128	– 152.6	33.063	– 41.6	– 45.886	28.4	.150	6.5
250.00	.144	– 153.4	32.220	– 51.6	– 44.026	30.1	.148	13.7
300.00	.162	– 156.8	31.300	– 60.1	– 43.385	56.6	.159	19.6
350.00	.173	– 159.8	30.270	– 68.4	– 43.056	76.0	.171	22.6
400.00	.187	– 163.6	29.200	– 74.7	– 41.723	80.0	.186	22.8
450.00	.199	– 167.2	28.195	– 80.2	– 43.575	79.7	.204	21.9
500.00	.206	– 170.2	27.005	– 84.7	– 43.475	100.7	.216	20.4
550.00	.214	– 174.7	25.949	– 87.7	– 42.361	109.1	.227	17.7
600.00	.218	– 177.3	24.986	– 91.3	– 41.674	113.8	.235	15.0
650.00	.224	– 179.3	23.911	– 93.2	– 41.737	124.4	.242	11.7
700.00	.231	177.6	22.988	– 93.9	– 41.177	136.8	.250	9.1
750.00	.235	175.3	22.115	– 94.7	– 39.808	145.0	.254	5.2
800.00	.236	174.4	21.219	– 95.5	– 40.644	146.3	.257	2.0
850.00	.236	171.4	20.260	– 94.9	– 39.305	157.6	.263	– 1.0
900.00	.241	169.0	19.466	– 95.3	– 40.113	164.8	.264	– 4.3
950.00	.244	167.8	18.642	– 95.6	– 38.682	174.7	.269	– 7.5
1000.00	.244	166.4	17.897	– 93.6	– 39.150	– 179.7	.272	– 10.3

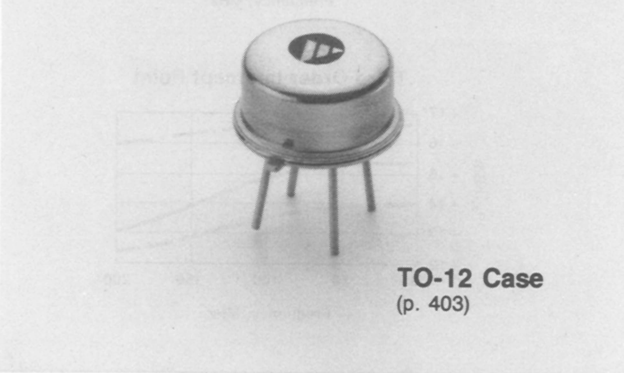
GPD-202

Thin Film Cascadable Amplifier Module
5-200 MHz

AVANTEK

FEATURES

- **High Gain: 30 dB (Typ)**
- **Medium Output Level: +11 dBm (Typ)**
- **Low Cost**
- **Small Size**



TO-12 Case
(p. 403)

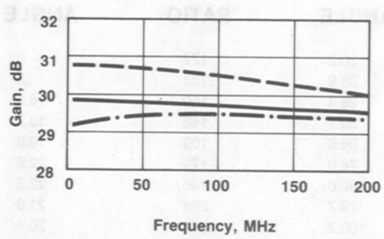
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	5-200	5-200	5-200	MHz
GP	Small Signal Gain	30.0	25.0 Min.	23.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	5.5	—	—	dB
—	Reverse Isolation	28.0			dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+11.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+18.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+20.0	—	—	dBm
I_D	DC Current	60		—	mA

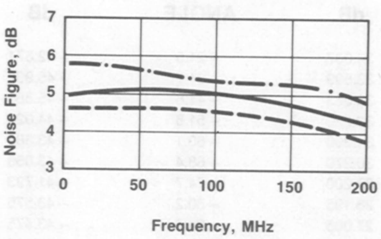
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

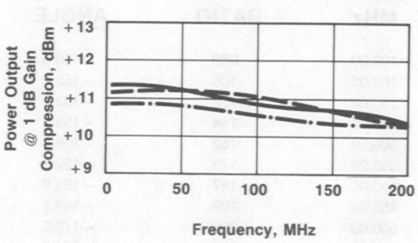
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

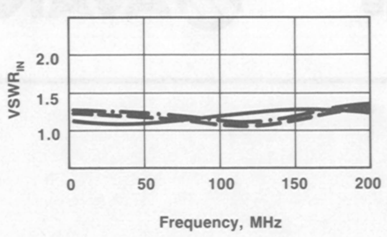
THERMAL CHARACTERISTICS*

θ_{JC}	160°C/W
Active Transistor Power Dissipation	117 mW
Junction Temperature Above Case Temperature	18.8°C
MTBF	1,621,478 Hrs.

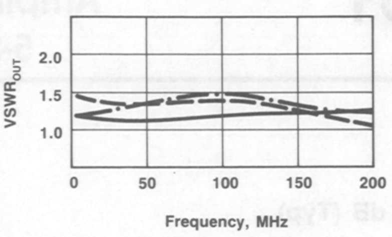
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams

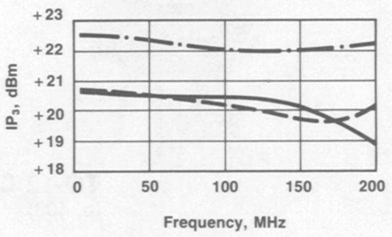
Input VSWR



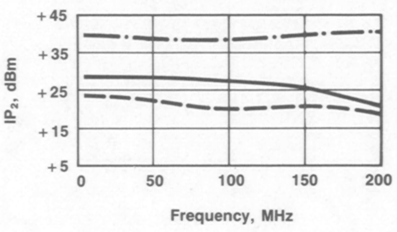
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.12	30.00	– 16.42	.10	.00	1.17	58.12
150.0	1.17	29.68	– 24.50	– .20	.43	1.22	46.81
200.0	1.23	29.27	– 31.95	.10	.42	1.25	46.32
250.0	1.29	28.71	– 39.74		.40	1.30	47.00
300.0	1.34	28.08	– 46.54		.38	1.35	48.35
350.0	1.40	27.43	– 53.39		.35	1.39	45.49
400.0	1.45	26.61	– 59.25		.30	1.43	48.21
450.0	1.50	25.89	– 64.05		.26	1.47	46.06
500.0	1.53	25.03	– 68.45		.21	1.49	46.03
550.0	1.57	24.18	– 71.53		.19	1.51	44.99
600.0	1.61	23.41	– 75.32		.18	1.53	45.06
650.0	1.63	22.52	– 77.92		.11	1.54	44.21
700.0	1.65	21.77	– 79.36		.07	1.55	43.24
750.0	1.68	21.03	– 80.55		.07	1.55	43.10
800.0	1.70	20.28	– 81.73		10.03	1.56	42.79
850.0	1.71	19.41	– 81.71		10.02	1.56	42.09
900.0	1.73	18.67	– 82.46		.03	1.55	41.65
950.0	1.76	17.91	– 82.91		9.98	1.56	41.10
1000.0	1.76	17.23	– 81.72		9.98	1.57	41.14

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.053	– 93.5	29.974	– 16.5	– 47.603	33.3	.087	22.5
150.00	.078	– 97.9	29.675	– 24.5	– 45.367	7.5	.101	32.5
200.00	.103	– 105.1	29.286	– 31.8	– 46.409	14.1	.118	36.0
250.00	.127	– 114.3	28.726	– 39.8	– 47.945	63.9	.130	38.2
300.00	.150	– 120.9	28.084	– 46.4	– 45.731	52.9	.150	38.0
350.00	.168	– 126.8	27.376	– 53.5	– 45.001	66.9	.163	37.4
400.00	.186	– 133.4	26.609	– 59.1	– 44.254	77.6	.175	35.8
450.00	.201	– 139.3	25.889	– 64.1	– 45.714	91.1	.188	33.7
500.00	.214	– 144.3	25.004	– 68.2	– 46.501	95.0	.197	31.3
550.00	.224	– 149.3	24.177	– 71.4	– 44.719	109.6	.205	27.9
600.00	.234	– 153.8	23.397	– 75.3	– 43.458	112.8	.211	25.3
650.00	.244	– 157.0	22.526	– 77.9	– 43.576	129.7	.213	21.7
700.00	.252	– 161.3	21.772	– 79.2	– 44.257	145.0	.216	18.8
750.00	.260	– 165.0	21.026	– 80.4	– 42.019	148.5	.217	14.8
800.00	.265	– 166.9	20.260	– 81.7	– 42.073	152.7	.217	10.8
850.00	.267	– 170.0	19.390	– 81.6	– 42.275	161.4	.220	7.9
900.00	.274	– 172.8	18.680	– 82.2	– 42.666	166.9	.219	4.0
950.00	.278	– 174.9	17.918	– 82.9	– 40.661	– 176.2	.221	.3
1000.00	.280	– 176.2	17.200	– 81.7	– 41.655	178.6	.222	– 3.1

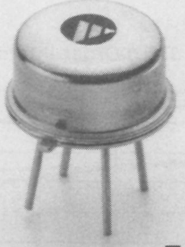
GPD-251

Thin Film Cascadable Amplifier Module 5-200 MHz

AVANTEK

FEATURES

- **5 Volt Bias**
- **High Gain: 27 dB (Typ)**
- **Low Cost**
- **Small Size**



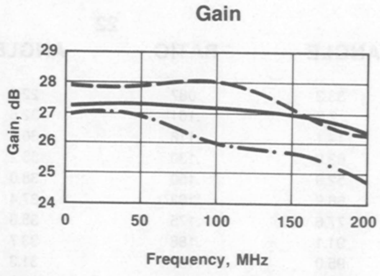
TO-12 Case
(p. 403)

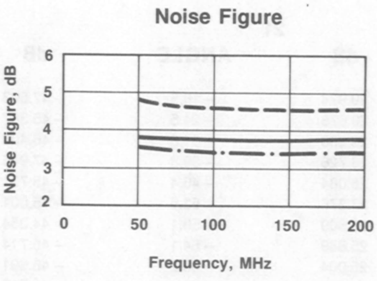
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +5 VDC nominal)

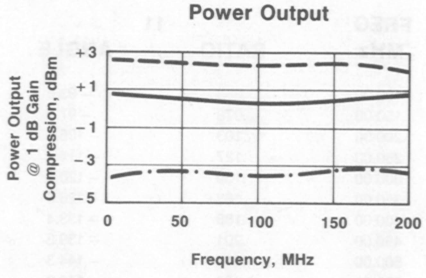
Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		T_C = 25°C	T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	5-200	5-200	5-200	MHz
GP	Small Signal Gain	27.0	25.0 Min.	23.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	4.0	—	—	dB
—	Reverse Isolation	28.0			dB
$P_{1\ dB}$	Power Output @ + 1 dB Compression	+1.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+10.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+22.0	—	—	dBm
I_D	DC Current	30		—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +5 VDC unless noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

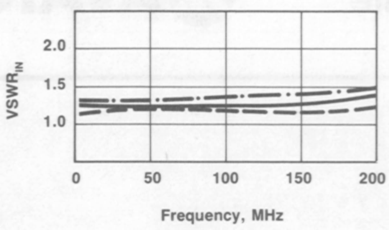
DC Voltage .... +12 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

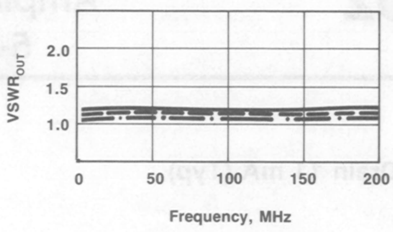
THERMAL CHARACTERISTICS*

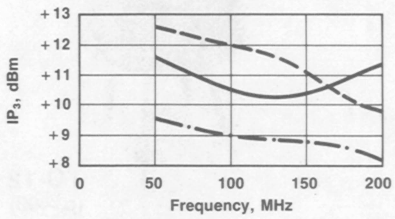
θ_{JC} .... 160°C/W
Active Transistor Power Dissipation .... 38.4 mW
Junction Temperature Above Case Temperature .... 6°C
MTBF .... 1,678,323 Hrs.

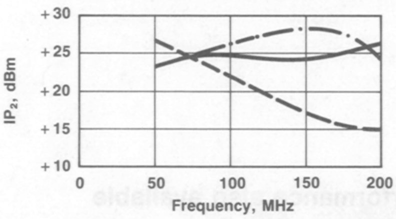
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams


Input VSWR


Output VSWR


Third-Order Intercept Point


Second-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 5.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.30	26.85	– 18.13	.11	.00	1.12	49.96
150.0	1.34	26.52	– 27.54	– .23	50	1.12	49.00
200.0	1.43	26.01	– 36.25	.11	.47	1.14	44.42
250.0	1.50	25.41	– 44.49		.44	1.15	47.30
300.0	1.57	24.63	– 51.92		.40	1.16	48.12
350.0	1.63	23.87	– 58.94		.38	1.18	44.41
400.0	1.68	22.97	– 65.67		.32	1.19	47.34
450.0	1.73	22.04	– 70.41		.26	1.19	48.00
500.0	1.76	21.18	– 74.90		.23	1.19	49.28
550.0	1.79	20.19	– 78.51		.19	1.19	45.90
600.0	1.82	19.32	– 81.65		.15	1.18	46.52
650.0	1.83	18.46	– 83.95		.11	1.17	45.45
700.0	1.85	17.61	– 85.55		.07	1.17	46.48
750.0	1.87	16.81	– 86.49		.04	1.16	45.87
800.0	1.87	16.01	– 86.83		.02	1.15	45.02
850.0	1.87	15.17	– 87.27		.01	1.14	44.85
900.0	1.88	14.40	– 87.38		.00	1.13	46.17
950.0	1.89	13.68	– 87.38		9.98	1.12	44.82
1000.0	1.88	12.98	– 86.79		19.97	1.12	44.69

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 5.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.139	– 162.5	27.137	– 18.5	– 44.479	38.4	.050	175.0
150.00	.159	– 154.9	26.804	– 28.2	– 47.583	20.7	.058	170.5
200.00	.185	– 156.6	26.299	– 36.7	– 48.131	16.6	.066	161.4
250.00	.206	– 159.2	25.656	– 45.2	– 47.285	55.0	.073	152.3
300.00	.227	– 162.4	24.852	– 52.4	– 44.079	39.6	.079	142.0
350.00	.249	– 166.4	24.046	– 59.7	– 46.115	68.9	.085	133.8
400.00	.264	– 170.0	23.168	– 66.3	– 44.291	66.4	.089	125.7
450.00	.271	– 173.8	22.228	– 71.2	– 47.319	68.9	.086	117.8
500.00	.278	– 178.1	21.313	– 75.4	– 47.221	82.0	.089	110.9
550.00	.288	177.5	20.337	– 79.1	– 47.594	104.2	.087	104.6
600.00	.297	175.1	19.458	– 82.2	– 44.654	101.1	.086	98.6
650.00	.298	173.5	18.598	– 84.7	– 45.687	129.1	.082	92.7
700.00	.290	170.1	17.711	– 85.9	– 45.548	123.8	.078	86.8
750.00	.296	165.8	16.899	– 86.8	– 44.792	138.8	.075	81.3
800.00	.307	164.3	16.106	– 87.1	– 44.762	145.2	.070	76.0
850.00	.310	163.1	15.248	– 87.6	– 44.401	154.1	.067	70.5
900.00	.306	162.2	14.498	– 87.5	– 46.183	162.0	.063	63.3
950.00	.298	159.9	13.778	– 87.5	– 43.106	– 175.6	.059	56.6
1000.00	.298	156.0	13.055	– 86.8	– 44.919	– 178.6	.055	50.0

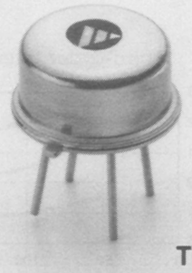
GPD-252

Thin Film Cascadable Amplifier Module
5-200 MHz

AVANTEK

FEATURES

- Low Current Drain 11 mA (Typ)
- 5 Volt Bias
- 16 dB Gain
- Low Cost



TO-12 Case
(p. 403)

NOTE: High Performance also available (see PPA-253 p. 26)

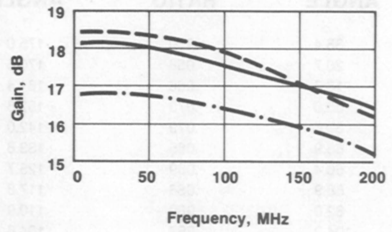
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +5 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$-$50°C$	Guaranteed Specifications $T_C = -55°$-$+85°C$	Unit
BW	Frequency Range	5-200	5-200	5-200	MHz
GP	Small Signal Gain	16.0	15.0 Min.	14.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	4.0	—	—	dB
—	Reverse Isolation	20.0			dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+0.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+12.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+16.0	—	—	dBm
I_D	DC Current	11		—	mA

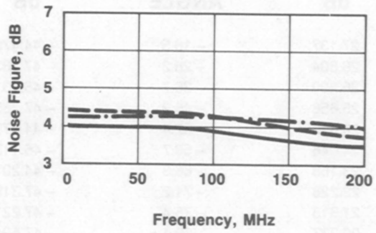
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +5 VDC unless otherwise noted)

KEY: +25°C ———
+85°C — — — —
−55°C —·—·—

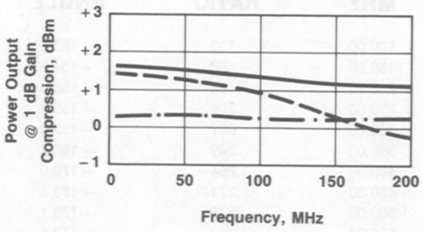
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage	+12 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	-55°C to +125°C
Storage Temperature	-62°C to +150°C
"R" Series Burn-In Temperature	+125°C

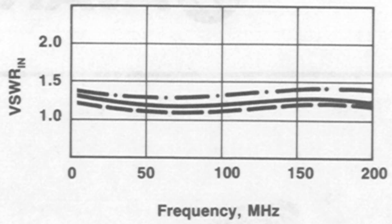
THERMAL CHARACTERISTICS*

θ_{JC}	150°C/W
Active Transistor Power Dissipation	8 mW
Junction Temperature Above Case Temperature	1.2°C
MTBF	2,000,740 Hrs.

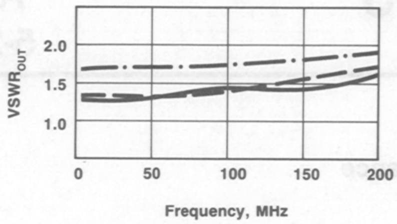
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams

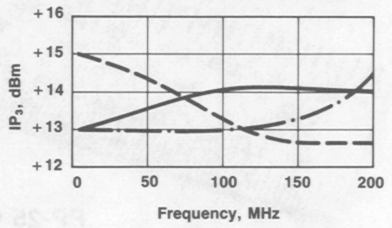
Input VSWR



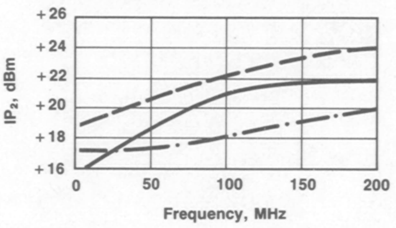
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 5.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.17	17.72	170.96	.21	.00	1.48	45.93
150.0	1.27	17.11	167.48	− .43	.16	1.44	37.18
200.0	1.24	16.47	165.32	.21	.08	1.59	38.02
250.0	1.24	15.74	164.43		10.00	1.65	34.80
300.0	1.23	15.14	165.41		19.95	1.73	34.26
350.0	1.24	14.43	166.16		19.90	1.80	29.16
400.0	1.27	13.78	169.08		19.88	1.84	27.98
450.0	1.30	13.23	170.54		19.88	1.88	27.23
500.0	1.33	12.53	173.43		19.83	1.92	26.82
550.0	1.35	12.11	176.61		19.85	1.94	26.84
600.0	1.38	11.62	178.84		19.82	1.98	26.63
650.0	1.43	11.06	− 176.94		19.81	2.02	26.40
700.0	1.47	10.73	− 174.33		19.85	2.06	26.18
750.0	1.51	10.33	− 171.41		19.83	2.09	26.13
800.0	1.53	9.80	− 168.41		19.80	2.13	25.89
850.0	1.55	9.51	− 164.18		19.79	2.17	25.56
900.0	1.60	9.07	− 160.97		19.80	2.19	25.31
950.0	1.66	8.61	− 157.12		19.80	2.24	24.77
1000.0	1.69	8.35	− 153.65		19.79	2.30	24.41

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 5.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.095	174.6	17.662	170.2	− 26.104	21.1	.163	28.8
150.0	.095	177.6	17.021	167.3	− 25.690	29.1	.204	26.8
200.0	.093	− 178.2	16.449	165.7	− 25.590	36.2	.228	22.4
250.0	.097	− 174.3	15.644	164.8	− 25.752	44.2	.250	19.1
300.0	.107	− 175.0	15.066	165.5	− 25.551	51.8	.269	14.8
350.0	.121	− 171.0	14.409	166.3	− 25.690	60.5	.288	11.5
400.0	.130	− 171.4	13.793	169.3	− 25.566	69.6	.297	7.8
450.0	.136	− 171.8	13.213	170.4	− 25.902	79.1	.307	4.1
500.0	.146	− 174.8	12.501	173.2	− 25.790	86.4	.315	.8
550.0	.163	− 179.2	12.106	176.3	− 25.933	96.0	.322	− 2.6
600.0	.180	− 178.7	11.591	178.7	− 25.795	106.1	.328	− 6.5
650.0	.188	− 178.3	11.007	− 177.2	− 25.731	115.1	.338	− 10.0
700.0	.191	178.8	10.668	− 174.9	− 25.587	125.0	.347	− 12.7
750.0	.202	175.5	10.246	− 171.8	− 25.558	134.1	.352	− 16.1
800.0	.217	173.4	9.770	− 168.7	− 25.171	144.7	.359	− 19.2
850.0	.231	172.0	9.450	− 164.4	− 25.028	154.4	.366	− 22.0
900.0	.238	171.5	8.973	− 161.2	− 24.726	164.9	.373	− 24.9
950.0	.244	169.7	8.570	− 157.7	− 24.172	173.2	.381	− 28.0
1000.0	.253	165.9	8.310	− 154.3	− 23.810	− 178.0	392	− 30.7

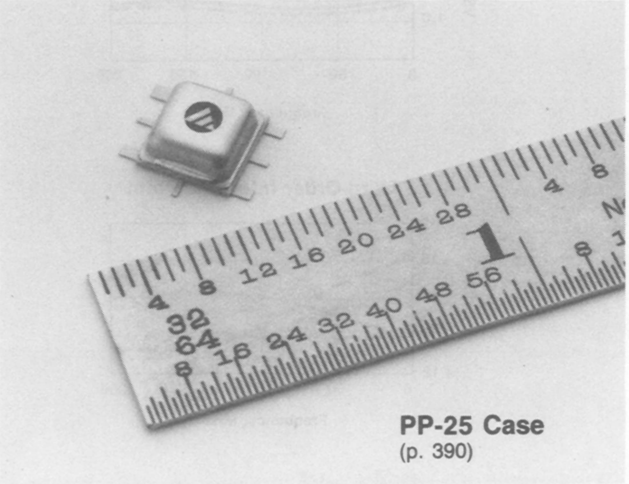
PPA-253

Surface Mounted Amplifier 5-200 MHz

AVANTEK

FEATURES

- **High Performance**
- **5 Volt Bias**
- **32 dB Gain**



PP-25 Case
(p. 390)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +5 VDC nominal)[1]

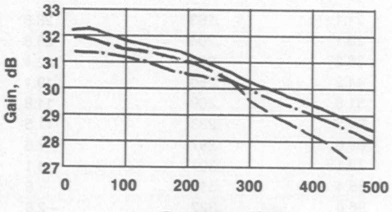
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	5-200	5-200	5-200	MHz
GP	Small Signal Gain	32.0	29.0 Min.	28.0 Min.	dB
—	Gain Flatness	±0.5	±0.5	±1.0	dB
NF	Noise Figure	3.0	4.0	4.0	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+3.0	0.0 Min.	−2.0 Min.	dBm
—	Input VSWR	1.2:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.5:1	2.0:1 Max.	2.0:1 Max.	
IP_3	Two Tone 3rd Order Intercept Point	+14.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+23.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+29.0			dBm
I_D	DC Current	30		—	mA

[1] The PPA-253 is based on the GPD-252.

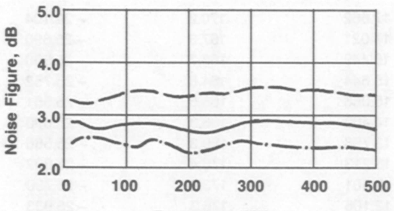
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +5 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

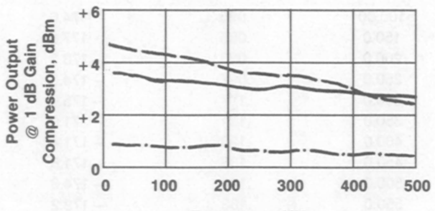
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage	+12 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

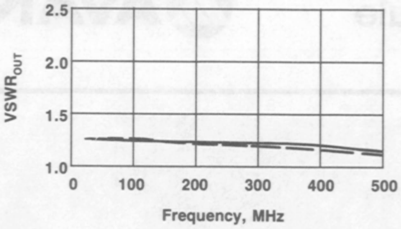
THERMAL CHARACTERISTICS*

θ_{JC}	160/160°C/W
Active Transistor Power Dissipation	24/43 mW
Junction Temperature Above Case Temperature	4/7°C

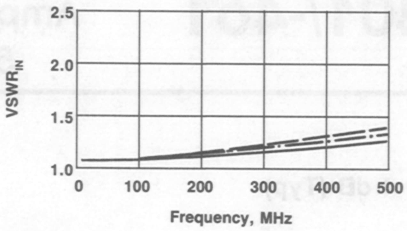
*For further information, see High Reliability section.

WEIGHT: (typical) — 0.25 grams

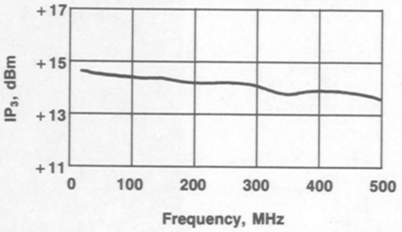
Output VSWR



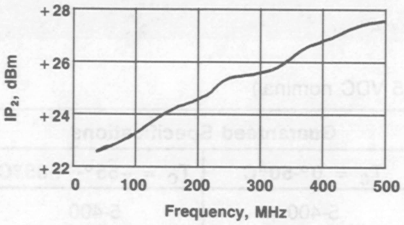
Input VSWR



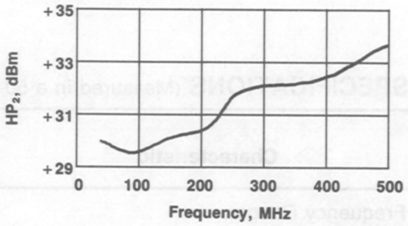
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	DEV LIN 0 DEG	GPDEL NSEC	VSWR OUT	REV ISOL dB
100.0	1.12	31.9	-.3	.587	1.42	46.8
150.0	1.17	31.5	.6	.630	1.43	46.7
200.0	1.22	31.4	-.3	.609	1.45	47.0
250.0	1.25	30.9		.547	1.46	47.0
300.0	1.30	30.5		.577	1.46	46.2
350.0	1.38	30.1		.577	.145	46.4
400.0	1.44	29.6		.535	1.44	46.2
450.0	1.51	29.1		.528	1.41	45.7
500.0	1.59	28.4		.504	1.38	45.6
600.0	1.73	27.1		.452	1.32	45.2
700.0	1.88	25.8		.401	1.25	44.2
800.0	1.98	24.6		.364	1.10	44.0
900.0	2.07	23.2		.334	1.12	43.2
1000.0	2.12	22.0		.323	1.07	42.6

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.059	-97.38	31.90	-23.9	-47.41	12.6	.176	-176.65
150.00	.079	-116.83	31.50	-34.5	-46.66	11.6	.178	-176.65
200.00	.099	-121.21	31.34	-46.6	-46.60	15.4	.183	-179.22
250.00	.112	-121.56	30.95	-56.4	-46.73	12.2	.186	178.94
300.00	.132	-119.26	30.53	-66.3	-46.39	16.6	.186	176.02
350.00	.158	-117.84	30.08	-77.1	-46.31	17.3	.184	173.85
400.00	.181	-118.71	29.62	-87.0	-46.21	21.0	.179	170.67
450.00	.203	-119.38	29.10	-96.3	-45.74	23.3	.170	167.98
500.00	.228	-122.53	28.45	-106.0	-45.64	26.4	.161	164.76
600.00	.267	-129.70	27.09	-123.6	-45.20	31.0	.137	160.38
700.00	.305	-136.94	25.76	-138.6	-44.15	34.6	.111	158.09
800.00	.329	-145.50	24.50	-152.4	-43.93	37.2	.081	160.06
900.00	.349	-154.13	23.22	-164.8	-43.18	38.4	.056	166.92
1000.00	.362	-162,31	22.04	-176.4	-42.69	37.1	.035	-173.10

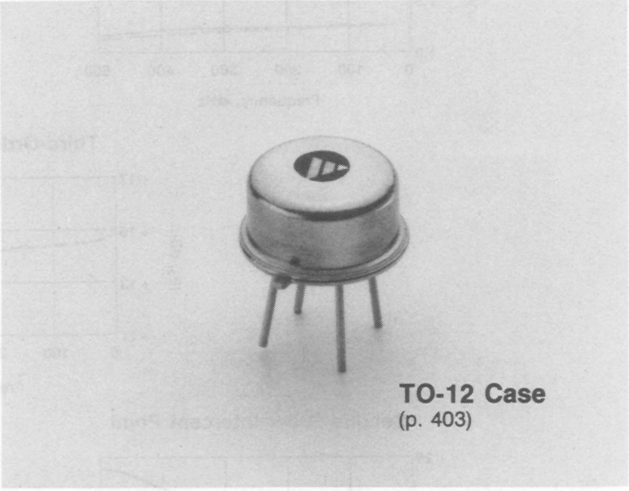
GPD-401/-461

Thin Film Cascadable Amplifier Module
5-400 MHz

AVANTEK

FEATURES

- **Low Noise: 4 dB (Typ)**
- **Low Cost**
- **Small Size**



TO-12 Case
(p. 403)

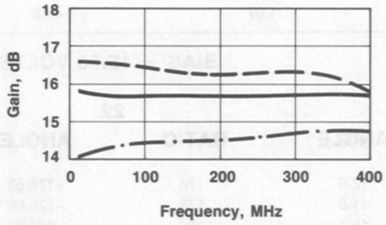
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°-50°C$	$T_C = -55°- +85°C$	Unit
BW	Frequency Range	5-400	5-400	5-400	MHz
GP	Small Signal Gain	15.5	13.0 Min.	12.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	4.0	—	—	dB
—	Reverse Isolation	20.0			dB
$P_{1 dB}$	Power Output @ + 1 dB Compression	−2.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+9.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+9.0	—	—	dBm
I_D	DC Current	10		—	mA

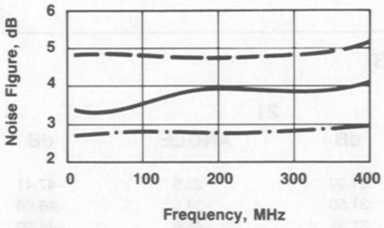
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

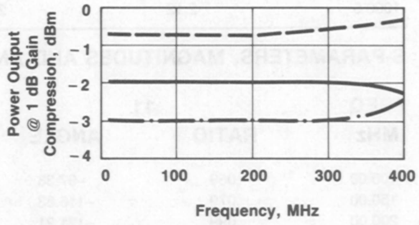
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

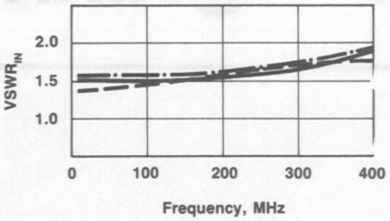
THERMAL CHARACTERISTICS*

θ_{JC}	150°C/W
Active Transistor Power Dissipation	14 mW
Junction Temperature Above Case Temperature	2°C
MTBF	2,045,316 (401)/2,388,527 (461) Hrs.

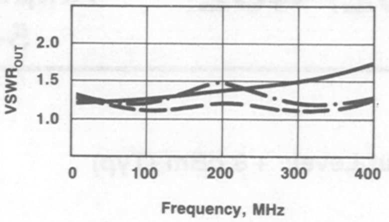
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams

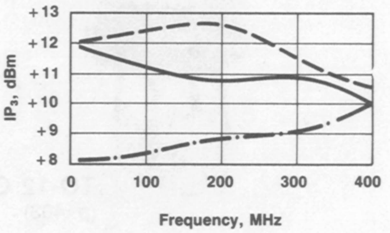
Input VSWR



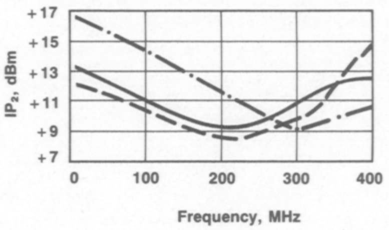
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.52	15.67	173.87	– .28	.00	1.29	21.66
150.0	1.53	15.59	170.27	– .06	.19	1.33	21.44
200.0	1.56	15.63	167.02	.51	.22	1.38	21.20
250.0	1.61	15.64	162.47	– .20	.22	1.44	21.21
300.0	1.68	15.71	159.15	.30	.21	1.53	20.98
350.0	1.79	15.81	154.98	– .04	.23	1.63	20.79
400.0	1.93	15.68	150.97	– .22	.21	1.76	20.73
450.0	2.13	15.70	147.51		.25	1.92	20.67
500.0	2.39	15.56	141.80		.27	2.12	20.47
550.0	2.70	15.33	137.78		.27	2.33	20.28
600.0	3.08	15.26	132.21		.33	2.60	20.44
650.0	3.52	14.74	126.06		.29	2.91	20.34
700.0	3.99	14.25	121.67		.25	3.26	20.34
750.0	4.48	13.80	117.03		.28	3.59	20.42
800.0	4.82	13.30	111.53		.25	3.93	20.84
850.0	5.01	12.24	108.12		.23	4.27	20.64
900.0	5.13	11.58	103.33		.28	4.50	21.50
950.0	5.19	10.74	97.99		10.13	4.69	20.83
1000.0	5.07	9.70	98.57		10.11	4.81	21.19

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.202	– 170.8	15.633	173.7	– 21.532	14.5	.128	20.6
150.00	.210	– 166.4	15.577	170.1	– 21.411	16.8	.139	33.2
200.00	.218	– 163.9	15.614	167.1	– 21.411	22.1	.161	41.4
250.00	.229	– 159.3	15.620	162.4	– 21.236	28.0	.182	47.3
300.00	.252	– 156.3	15.674	159.2	– 20.928	32.5	.210	49.9
350.00	.283	– 153.6	15.743	154.9	– 20.848	38.3	.239	52.8
400.00	.319	– 152.7	15.647	151.1	– 20.562	42.9	.273	55.1
450.00	.361	– 153.5	15.694	147.4	– 20.685	46.0	.310	55.2
500.00	.408	– 155.5	15.502	142.0	– 20.475	50.7	.355	54.6
550.00	.456	– 159.0	15.279	137.8	– 20.305	54.1	.398	52.9
600.00	.510	– 163.6	15.203	132.2	– 20.351	57.7	.441	50.3
650.00	.558	– 168.7	14.701	126.1	– 20.361	62.4	.487	46.7
700.00	.594	– 174.6	14.199	121.8	– 20.367	65.4	.528	42.7
750.00	.633	179.5	13.755	117.2	– 20.424	68.8	.565	37.8
800.00	.655	174.4	13.245	111.7	– 20.808	72.9	.594	32.7
850.00	.665	168.6	12.179	108.3	– 20.471	77.7	.619	27.8
900.00	.674	163.3	11.550	103.6	– 21.421	80.6	.637	22.9
950.00	.675	158.2	10.708	98.1	– 20.978	88.7	.648	18.1
1000.00	.668	153.5	9.645	98.8	– 21.209	90.3	.655	13.4

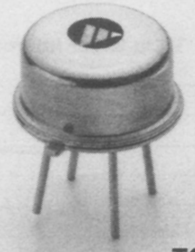
GPD-402/-462

Thin Film Cascadable Amplifier Module
5-400 MHz

AVANTEK

FEATURES

- **Medium Output Level: +8 dBm (Typ)**
- **Low Cost**
- **Small Size**



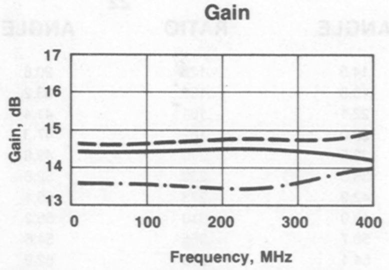
TO-12 Case
(p. 403)

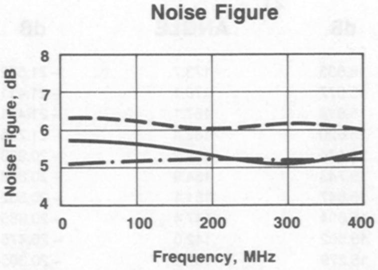
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

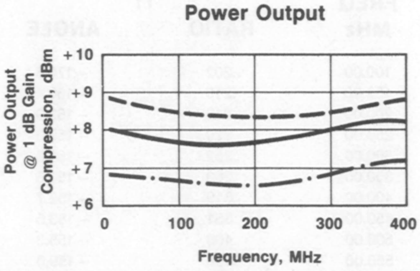
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	5-400	5-400	5-400	MHz
GP	Small Signal Gain	14.0	13.0 Min.	12.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	8.0	—	—	dB
—	Reverse Isolation	20.0			dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+8.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+18.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+24.0	—	—	dBm
I_D	DC Current	24		—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—







MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

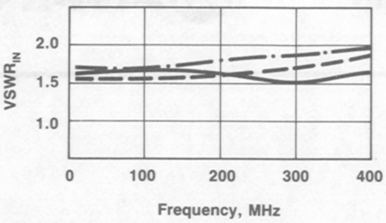
THERMAL CHARACTERISTICS*

θ_{JC} .... 150°C/W
Active Transistor Power Dissipation .... 82 mW
Junction Temperature Above Case Temperature ..... 12.3°C
MTBF .... 2,325,901 (402)/2,640,329 (462) Hrs.

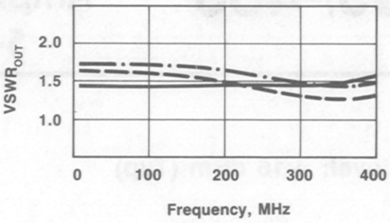
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams

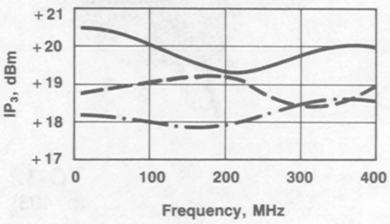
Input VSWR



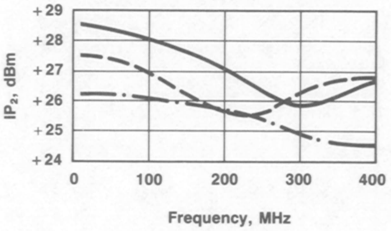
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.63	14.33	174.29	.02	.00	1.45	23.70
150.0	1.60	14.23	170.90	.05	.18	1.46	23.27
200.0	1.56	14.24	167.76	.33	.20	1.45	22.92
250.0	1.53	14.17	163.59	−.40	.20	1.45	22.76
300.0	1.53	14.23	160.48	−.11	.19	1.45	22.49
350.0	1.55	14.22	156.84	−.32	.18	1.47	22.00
400.0	1.58	14.09	154.18	.43	.17	1.51	21.79
450.0	1.68	14.11	150.88		.21	1.54	21.28
500.0	1.83	13.97	146.56		.21	1.61	21.01
550.0	2.06	13.81	143.23		.22	1.70	20.54
600.0	2.33	13.76	138.65		.26	1.82	20.37
650.0	2.67	13.38	133.97		.24	1.97	20.05
700.0	3.08	13.05	130.10		.22	2.15	19.79
750.0	3.60	12.74	126.17		.24	2.35	19.62
800.0	4.17	12.36	121.50		.22	2.58	19.88
850.0	4.74	11.56	118.16		.24	2.81	19.62
900.0	5.24	11.06	112.73		.27	3.05	20.33
950.0	5.71	10.37	108.40		.13	3.28	19.86
1000.0	6.03	9.51	108.17		.13	3.49	20.18

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.235	−179.6	14.333	174.0	−23.399	15.6	.183	3.2
150.00	.230	−178.7	14.267	170.8	−23.288	23.6	.181	8.7
200.00	.221	−177.6	14.297	167.9	−23.158	28.4	.183	11.3
250.00	.209	−173.3	14.225	163.6	−22.753	36.3	.181	14.4
300.00	.207	−168.0	14.267	160.7	−22.286	42.9	.185	18.2
350.00	.212	−160.8	14.253	156.9	−22.099	49.7	.187	24.2
400.00	.228	−154.2	14.179	154.0	−21.392	55.4	.196	29.4
450.00	.258	−148.9	14.178	150.5	−21.186	58.8	.209	34.4
500.00	.298	−146.4	13.985	146.4	−20.985	64.6	.231	38.2
550.00	.346	−145.8	13.839	142.9	−20.484	67.1	.259	41.0
600.00	.400	−147.2	13.746	138.4	−20.250	71.3	.292	41.7
650.00	.457	−150.1	13.382	133.7	−20.036	75.1	.329	41.1
700.00	.512	−154.7	13.047	130.0	−19.837	77.9	.366	39.4
750.00	.569	−159.7	12.735	126.1	−19.672	79.9	.406	36.7
800.00	.617	−164.5	12.341	121.4	−19.820	81.9	.441	32.8
850.00	.653	−170.0	11.520	118.1	−19.530	86.9	.478	29.0
900.00	.684	−175.4	11.057	112.9	−20.285	85.9	.509	24.5
950.00	.709	179.2	10.382	108.3	−19.932	93.3	.534	19.9
1000.00	.720	174.1	9.476	108.0	−20.194	93.0	.555	15.3

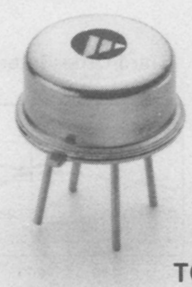
GPD-403/-463

Thin Film Cascadable Amplifier Module
5-400 MHz

AVANTEK

FEATURES

- **High Output Level: +16 dBm (Typ)**
- **24 Volt Bias**
- **Low Cost**
- **Small Size**



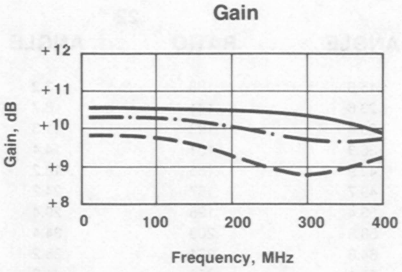
TO-12 Case
(p. 403)

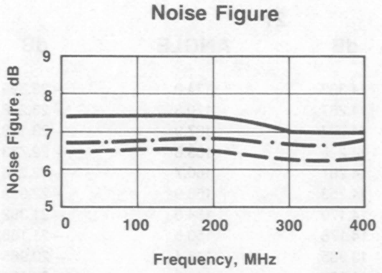
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +24 VDC nominal)

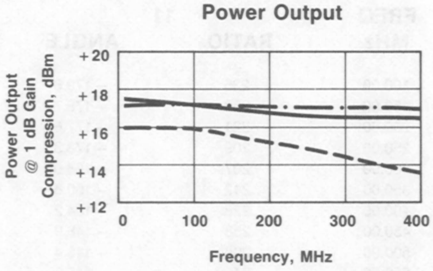
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-}+85°C$	
BW	Frequency Range	5-400	5-400	5-400	MHz
GP	Small Signal Gain	10.0	9.0 Min.	8.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	7.5	—	—	dB
—	Reverse Isolation	20.0			dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+16.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+25.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+32.0	—	—	dBm
I_D	DC Current	65		—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +24 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

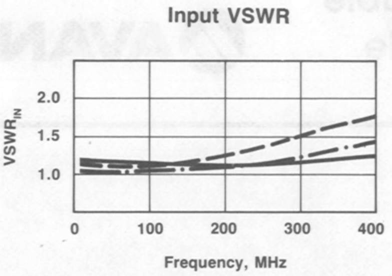
DC Voltage	+25 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	-55°C to +125°C
Storage Temperature	-62°C to +150°C
"R" Series Burn-In Temperature	+125°C

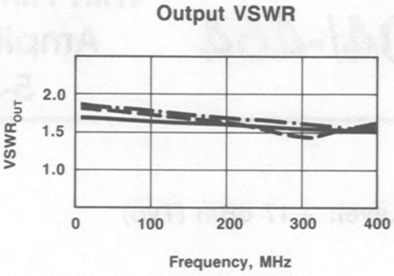
THERMAL CHARACTERISTICS*

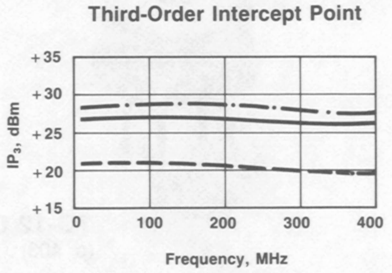
θ_{JC}	100°C/W
Active Transistor Power Dissipation	275 mW
Junction Temperature Above Case Temperature	27.5°C
MTBF	3,058,127 (403)/3,602,215 (463) Hrs.

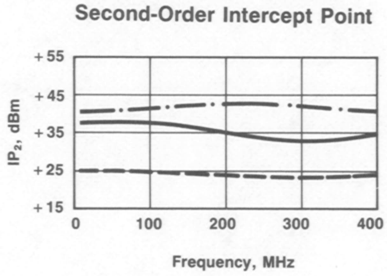
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams


Input VSWR


Output VSWR


Third-Order Intercept Point


Second-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 24.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.07	10.50	176.22	.39	.00	1.65	20.66
150.0	1.10	10.37	174.17	.56	.15	1.63	20.24
200.0	1.12	10.33	170.97	– .40	.16	1.62	20.03
250.0	1.16	10.14	168.32	– .83	.13	1.60	19.76
300.0	1.19	10.14	166.45	– .47	.10	1.57	19.52
350.0	1.24	10.04	164.55	– .13	.09	1.55	19.09
400.0	1.28	9.95	163.35	.88	.08	1.51	18.72
450.0	1.33	9.79	161.56		.08	1.48	18.40
500.0	1.38	9.59	160.50		.07	1.45	18.10
550.0	1.45	9.46	158.96		.10	1.41	17.64
600.0	1.52	9.24	156.90		.08	1.39	17.26
650.0	1.61	9.05	155.95		.07	1.35	16.95
700.0	1.70	8.89	154.22		.10	1.32	16.50
750.0	1.81	8.64	152.36		.10	1.29	16.19
800.0	1.95	8.31	150.69		.08	1.28	16.00
850.0	2.08	8.04	149.39		.07	1.25	15.57
900.0	2.23	7.58	148.04		.07	1.23	15.64
950.0	2.39	7.11	146.94		.06	1.21	15.07
1000.0	2.53	6.70	145.98		.04	1.19	14.79

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 24.00 VOLTS**

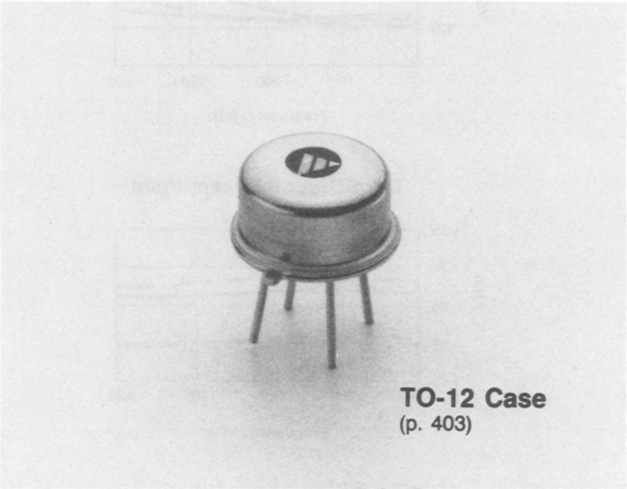
FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.033	– 121.8	10.482	176.1	– 20.574	17.0	.248	– 11.4
150.00	.049	– 116.6	10.369	174.0	– 20.272	24.0	.242	– 16.0
200.00	.059	– 115.5	10.352	171.1	– 20.208	30.4	.236	– 20.6
250.00	.075	– 115.0	10.160	168.3	– 19.797	38.1	.231	– 26.7
300.00	.089	– 117.5	10.149	166.6	– 19.324	44.8	.226	– 31.3
350.00	.105	– 119.1	10.018	164.4	– 19.131	51.8	.215	– 37.4
400.00	.126	– 121.5	9.947	163.4	– 18.672	58.1	.204	– 43.6
450.00	.144	– 123.9	9.812	161.4	– 18.416	63.5	.193	– 50.0
500.00	.162	– 126.4	9.572	160.6	– 18.125	69.5	.183	– 56.3
550.00	.182	– 130.4	9.470	158.9	– 17.575	74.6	.173	– 63.3
600.00	.209	– 133.6	9.238	156.9	– 17.317	78.9	.162	– 70.1
650.00	.237	– 136.8	9.045	155.9	– 16.931	84.5	.150	– 76.9
700.00	.262	– 141.5	8.896	154.2	– 16.538	88.7	.140	– 82.6
750.00	.291	– 146.6	8.638	152.4	– 16.183	93.1	.127	– 89.8
800.00	.323	– 151.3	8.281	150.7	– 16.035	96.6	.120	– 96.3
850.00	.353	– 156.3	7.988	249.5	– 15.561	102.2	.110	– 102.1
900.00	.379	– 161.5	7.540	148.3	– 15.625	103.5	.103	– 105.8
950.00	.405	– 166.5	7.060	147.3	– 15.202	111.2	.097	– 110.2
1000.00	.430	– 171.5	6.645	146.5	– 14.905	113.2	.090	– 114.7

GPD-404/-464 Thin Film Cascadable Amplifier Module 5-400 MHz

AVANTEK

FEATURES

- **High Output Level: +17 dBm (Typ)**
- **Low Cost**
- **Small Size**



TO-12 Case
(p. 403)

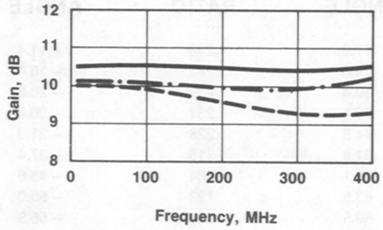
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = –55°- +85°C	Unit
BW	Frequency Range	5-400	5-400	5-400	MHz
GP	Small Signal Gain	10.0	9.0 Min.	8.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	7.5	—	—	dB
—	Reverse Isolation	20.0	—	—	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+17.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+26.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+38.0	—	—	dBm
I_D	DC Current	70	—	—	mA

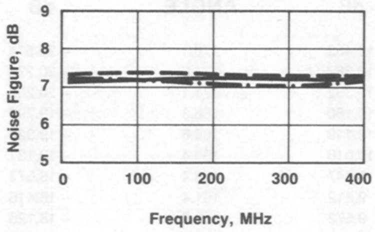
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
–55°C —·—·—

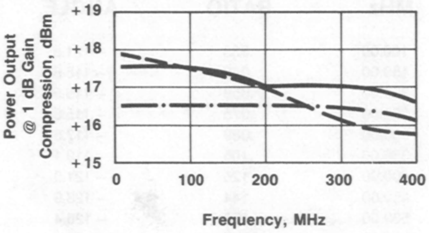
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... -55°C to +115°C
Storage Temperature .... -62°C to +150°C
"R" Series Burn-In Temperature .... +115°C

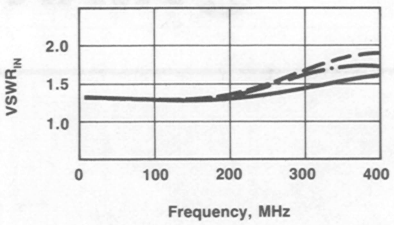
THERMAL CHARACTERISTICS*

θ_{JC} .... 100°C/W
Active Transistor Power Dissipation .... 330 mW
Junction Temperature Above Case Temperature .... 33°C
MTBF .... 2,435,672 (404)/2,512,908 (464) Hrs.

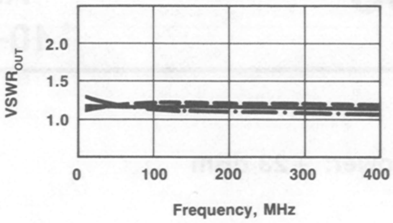
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams

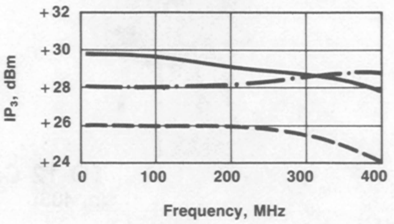
Input VSWR



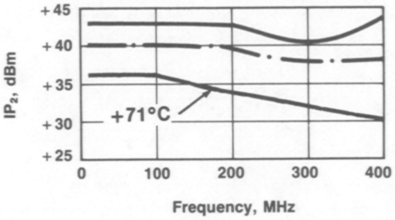
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.32	10.54	178.94	.07	.00	1.11	22.94
150.0	1.33	10.48	177.20	– .07	.07	1.10	22.53
200.0	1.36	10.48	176.26	.55	.10	1.09	22.11
250.0	1.40	10.44	173.60	– .53	.11	1.10	22.07
300.0	1.44	10.49	172.17	– .39	.07	1.08	21.80
350.0	1.50	10.56	171.03	.04	.07	1.09	21.43
400.0	1.57	10.59	169.72	.31	.07	1.10	21.09
450.0	1.66	10.55	168.68		.06	1.12	20.76
500.0	1.75	10.56	167.56		.08	1.14	20.52
550.0	1.90	10.46	165.67		.10	1.18	20.09
600.0	2.05	10.38	163.83		.11	1.22	19.87
650.0	2.23	10.32	161.76		.13	1.25	19.52
700.0	2.44	10.17	159.27		.13	1.28	19.16
750.0	2.72	9.94	156.96		.13	1.31	18.89
800.0	3.04	9.63	154.77		.14	1.33	18.90
850.0	3.34	9.24	151.97		.13	1.35	18.43
900.0	3.66	8.76	150.15		.10	1.37	18.72
950.0	3.99	8.24	148.50		.09	1.37	18.20
1000.0	4.22	7.54	146.87		.05	1.36	18.05

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.134	– 164.2	10.510	178.5	– 22.866	13.7	.053	– 22.2
150.00	.142	– 158.3	10.495	176.9	– 22.529	21.5	.051	– 32.2
200.00	.153	– 155.0	10.485	176.3	– 22.392	28.5	.044	– 42.6
250.00	.163	– 150.7	10.466	173.4	– 21.934	35.5	.043	– 60.8
300.00	.181	– 147.2	10.488	172.1	– 21.655	41.8	.043	– 76.1
350.00	.199	– 144.4	10.519	170.9	– 21.382	47.4	.042	– 100.2
400.00	.222	– 142.7	10.578	169.8	– 20.861	54.1	.046	– 123.8
450.00	.247	– 142.3	10.548	168.6	– 20.826	58.2	.056	– 141.5
500.00	.277	– 142.3	10.518	167.6	– 20.497	64.2	.065	– 156.4
550.00	.308	– 143.0	10.458	165.6	– 19.989	68.7	.081	– 170.0
600.00	.343	– 144.5	10.363	163.8	– 19.753	73.0	.096	179.2
650.00	.381	– 146.5	10.318	161.7	– 19.460	78.4	.110	170.6
700.00	.421	– 149.8	10.161	159.3	– 19.193	81.3	.124	161.3
750.00	.465	– 153.5	9.929	157.0	– 18.834	84.9	.133	154.1
800.00	.506	– 157.1	9.618	154.8	– 18.894	87.9	.143	147.3
850.00	.541	– 161.8	9.217	151.9	– 18.414	93.4	.150	140.4
900.00	.574	– 166.4	8.762	150.4	– 18.700	93.7	.154	135.6
950.00	.604	– 171.0	8.239	148.5	– 18.299	101.6	.155	131.4
1000.00	.620	– 175.5	7.515	146.9	– 18.052	102.5	.156	127.5

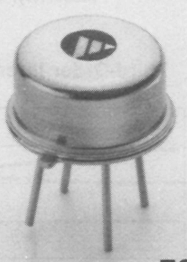
GPD-405

Thin Film Cascadable Amplifier
10-400 MHz

AVANTEK

FEATURES

- **High Output Power: +23 dBm**



TO-12 Case
(p. 403)

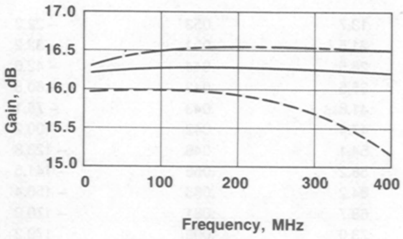
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°-50°C$	$T_C = -55°-+85°C$	Unit
BW	Frequency Range	10-400	10-400	10-400	MHz
GP	Small Signal Gain	16.2	13.0 Min.	12.0 Min.	dB
—	Gain Flatness	±1.0			dB
NF	Noise Figure	6.5	—	—	dB
—	Reverse Isolation	18.0			dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+23.0	—	—	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+29.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+34.0	—	—	dBm
I_D	DC Current	90		—	mA

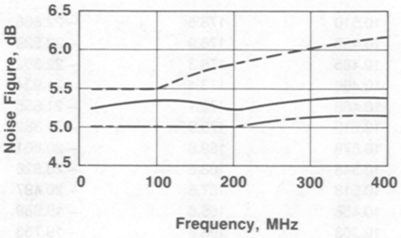
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ———
+85°C — — —
−55°C —·—·—

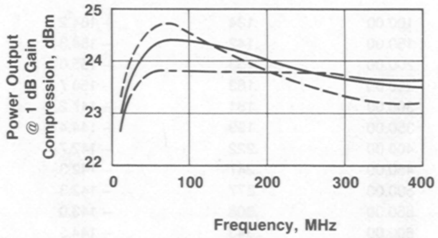
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

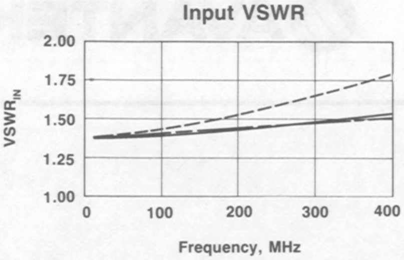
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +100°C

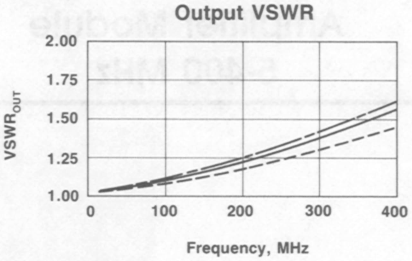
THERMAL CHARACTERISTICS*

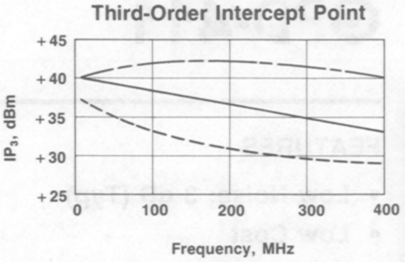
θ_{JC} .... 80°C/W
Active Transistor Power Dissipation .... 750 mW
Junction Temperature Above Case Temperature .... 60°C
MTBF .... 1,607,022 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams







AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.38	16.20	165.16	.25	.00	1.04	22.21
120.0	1.39	16.24	161.88	.43	.48	1.07	22.16
140.0	1.40	16.26	158.27	.27	.50	1.11	22.08
160.0	1.40	16.26	154.64	.12	.51	1.14	22.08
180.0	1.42	16.26	150.91	–.13	.52	1.18	21.93
200.0	1.42	16.23	147.23	–.35	.50	1.21	22.03
220.0	1.43	16.19	143.73	–.39	.47	1.24	21.97
240.0	1.44	16.20	140.45	–.19	.47	1.27	21.90
260.0	1.45	16.24	136.96	–.23	.49	1.31	21.82
280.0	1.47	16.24	133.43	–.31	.49	1.34	21.77
300.0	1.48	16.23	129.91	–.35	.48	1.38	21.82
320.0	1.49	16.18	126.56	–.22	.45	1.41	21.79
340.0	1.50	16.13	123.38	.04	.43	1.44	21.74
360.0	1.52	16.14	120.33	.45	.45	1.47	21.65
380.0	1.53	16.18	116.88	.48	.50	1.50	21.55
400.0	1.55	16.19	113.08	.16	.47	1.54	21.51
500.0	1.65	16.08	96.48	—	.47	1.70	21.33
600.0	1.74	16.01	79.26	—	.48	1.87	21.18
700.0	1.87	15.82	61.65	—	.46	2.02	20.72
800.0	1.99	15.23	46.15	—	.47	2.15	20.63
900.0	2.09	14.96	27.75	—	.53	2.29	20.64
1000.0	2.18	14.57	8.14	—	.55	2.40	20.41
1100.0	2.19	14.19	–11.95	—	.55	2.60	20.51
1200.0	2.10	13.51	–31.20	—	.56	2.88	21.20
1300.0	1.91	12.14	–52.31	—	.58	3.27	21.84

LINEARIZATION RANGE: 100.0 TO 400.0

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.160	–165.8	16.277	176.8	–22.221	12.0	.026	–100.4
120.00	.160	–164.0	16.314	176.2	–22.221	12.6	.041	–98.2
140.00	.163	–163.9	16.313	175.1	–22.080	14.0	.058	–94.9
160.00	.166	–163.5	16.327	173.8	–21.991	15.6	.073	–97.5
180.00	.175	–163.2	16.338	172.5	–21.999	16.0	.086	–100.9
200.00	.175	–163.6	16.298	171.2	–22.012	18.5	.100	–104.4
220.00	.177	–163.4	16.265	170.1	–21.997	20.7	.112	–109.1
240.00	.180	–163.2	16.252	169,2	–21.951	22.6	.124	–111.8
260.00	.184	–162.9	16.290	168.2	–21.857	23.8	.138	–115.1
280.00	.188	–162.5	16.303	167.1	–21.745	25.1	.153	–117.9
300.00	.191	–162.1	16.277	165.9	–21.823	27.0	.166	–119.9
320.00	.196	–162.3	16.232	165.0	–21.804	28.4	.176	–122.8
340.00	.200	–162.5	16.188	164.2	–21.786	30.4	.186	–125.5
360.00	.205	–162.7	16.208	163.5	–21.656	31.8	.196	–128.1
380.00	.209	–163.2	16.238	162.3	–21.593	33.2	.205	–131.5
400.00	.213	–163.6	16.221	161.0	–21.561	34.8	.218	–134.8
500.00	.239	–166.1	16.133	156.2	–21.298	41.6	.267	–148.2
550.00	.254	–169.2	16.074	152.6	–21.117	43.9	.286	–156.6
600.00	.267	–172.2	15.920	151.2	–21.056	47.1	.312	–164.2
650.00	.285	–174.5	16.003	149.4	–20.747	50.2	.330	–170.4
700.00	.304	–178.6	15.851	146.3	–20.563	52.0	.336	–178.9
750.00	.316	177.3	15.605	143.9	–20.459	54.1	.350	170.9
800.00	.331	174.2	15.349	142.3	–20.525	56.7	.374	161.9
850.00	.349	169.5	15.191	138.1	–20.200	59.1	.384	153.4
900.00	.357	164.1	15.056	135.6	–20.612	60.1	.383	142.0
950.00	.368	159.9	15.058	132.4	–20.356	63.1	.397	129.7
1000.00	.382	154.7	14.631	127.7	–20.518	63.4	.408	118.5

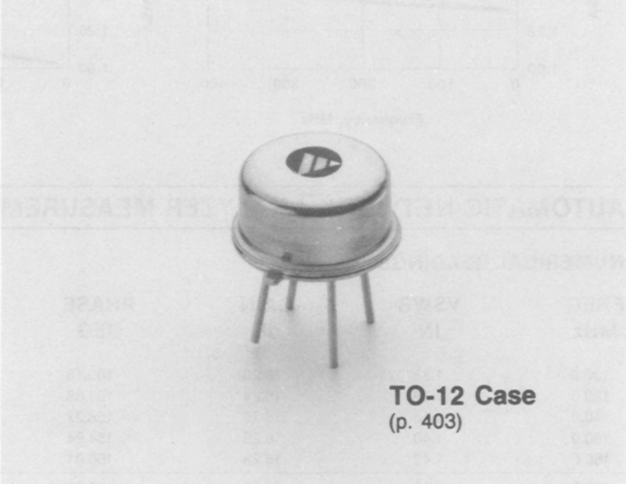
GPD-411

Thin Film Cascadable Amplifier Module
5-400 MHz

AVANTEK

FEATURES

- **Low Noise: 3 dB (Typ)**
- **Low Cost**
- **Small Size**

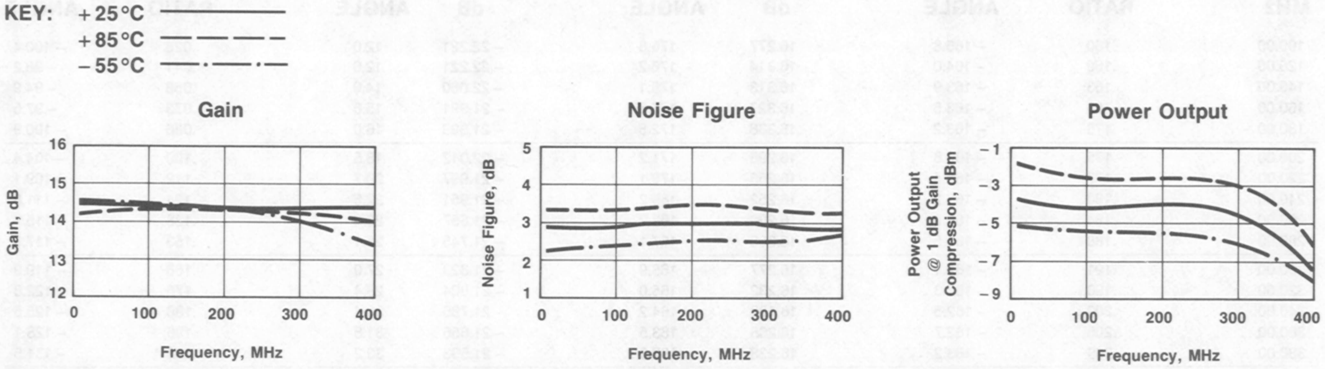


TO-12 Case
(p. 403)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°-50°C$	$T_C = -55°- +85°C$	Unit
BW	Frequency Range	5-400	5-400	5-400	MHz
GP	Small Signal Gain	—	12.0 Min.	11.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	3.0	—	—	dB
—	Reverse Isolation	18.0			dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	−6.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+4.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+6.0	—	—	dBm
I_D	DC Current	7		—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)



MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

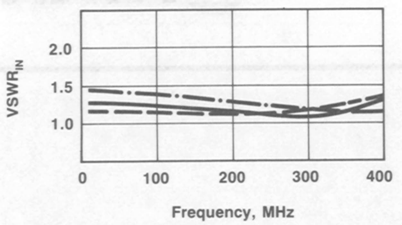
THERMAL CHARACTERISTICS*

θ_{JC}	160°C/W
Active Transistor Power Dissipation	23.6 mW
Junction Temperature Above Case Temperature	3.8°C
MTBF	1,608,303 Hrs.

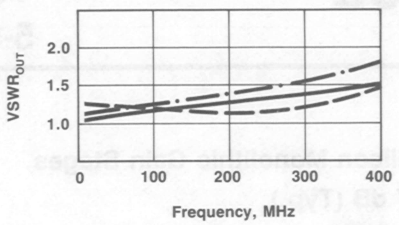
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams

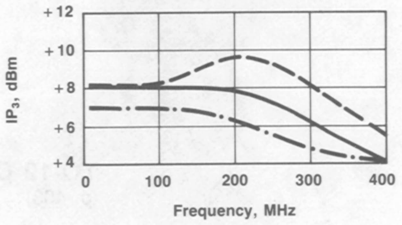
Input VSWR



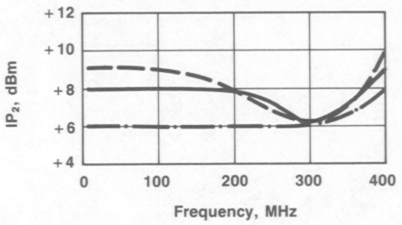
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.16	14.43	175.96	.45	.00	1.07	18.89
150.0	1.13	14.41	173.40	.16	.15	1.10	19.16
200.0	1.10	14.29	170.52	– .44	.14	1.15	19.03
250.0	1.10	14.28	168.36	– .33	.13	1.20	18.85
300.0	1.12	14.23	165.99	– .43	.11	1.28	18.88
350.0	1.19	14.20	164.26	.11	.10	1.37	18.59
400.0	1.32	14.25	162.37	.48	.16	1.48	18.42
450.0	1.52	14.18	158.38		.20	1.64	18.18
500.0	1.81	14.18	155.28		.25	1.87	18.08
550.0	2.30	14.30	149.36		.36	2.19	17.81
600.0	3.29	14.01	142.52		.42	2.64	18.00
650.0	5.62	13.78	134.30		.57	3.31	18.38
700.0	11.68	12.74	122.18		.64	4.43	19.33
750.0	33.90	10.82	111.34		.43	5.77	21.27
800.0	624.22	8.28	106.76		.18	6.74	24.56
850.0	107.14	5.65	104.78		9.84	6.95	28.15
900.0	29.34	3.02	112.43		19.47	6.87	34.31
950.0	15.86	1.13	123.99		19.38	6.79	38.66
1000.0	11.29	– .33	134.89		19.37	6.63	37.14

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.115	161.8	14.519	175.6	– 19.416	9.5	.077	3.7
150.00	.103	148.8	14.369	173.3	– 19.099	13.9	.087	– 4.6
200.00	.080	138.6	14.309	170.8	– 19.092	16.5	.104	– 14.0
250.00	.058	119.0	14.233	168.2	– 18.857	20.5	.129	– 20.5
300.00	.039	77.3	14.239	166.1	– 18.869	24.2	.150	– 30.7
350.00	.055	10.4	14.208	163.9	– 18.565	26.4	.180	– 40.9
400.00	.104	– 18.9	14.240	161.7	– 18.388	28.8	.214	– 51.0
450.00	.175	– 35.7	14.104	157.7	– 18.086	29.4	.252	– 62.4
500.00	.266	– 49.1	14.058	154.7	– 17.961	28.8	.304	– 72.5
550.00	.387	– 61.9	14.128	148.9	– 17.553	26.1	.368	– 83.2
600.00	.528	– 75.7	13.762	142.3	– 17.693	19.0	.442	– 94.6
650.00	.696	– 91.4	13.447	135.0	– 18.240	12.3	.523	– 106.1
700.00	.855	– 108.8	12.485	124.3	– 19.094	1.4	.610	– 119.7
750.00	.979	– 127.6	10.764	114.0	– 21.247	– 12.1	.681	– 133.0
800.00	1.036	– 144.3	8.365	109.4	– 24.918	– 21.8	.716	– 145.4
850.00	1.018	– 158.3	5.904	106.8	– 28.475	– 29.3	.729	– 157.1
900.00	.982	– 169.9	3.458	113.4	– 35.677	– 41.2	.736	– 166.6
950.00	.931	– 179.1	1.598	123.5	– 42.218	– 90.5	.738	– 174.2
1000.00	.872	173.7	.122	133.1	– 40.284	– 170.2	.739	179.3

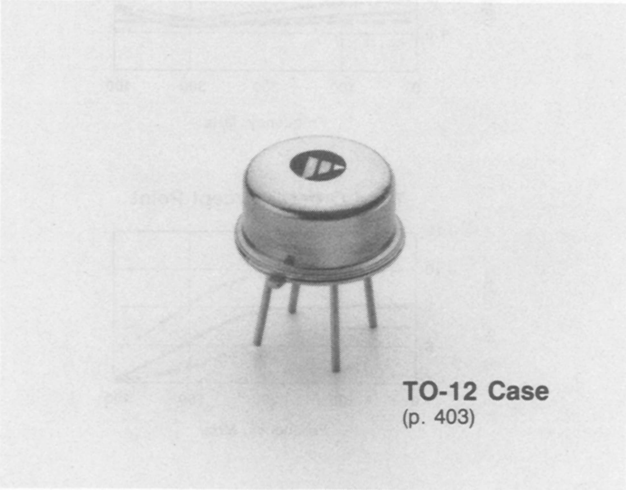
GPM-552

High Gain Modular Amplifier 5-500 MHz

AVANTEK

FEATURES

- **MODAMP™ Silicon Monolithic Gain Stages**
- **High Gain: 37 dB (Typ.)**
- **Increased Reliability**



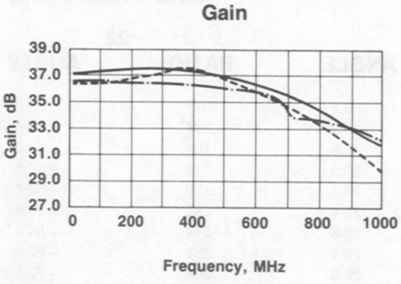
TO-12 Case
(p. 403)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

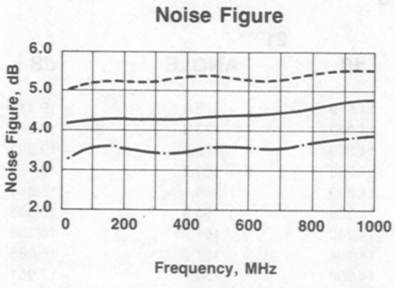
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	37.0	33.0 Min.	32.0 Min.	dB
—	Gain Flatness	±0.2	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.5	6.0 Max.	7.0 Max.	dB
—	Reverse Isolation	20.0	—	—	dB
$P_{1 dB}$	Power Output @ + 1 dB Compression	0	−4.0 Min.	−6.0 Min.	dBm
—	Input VSWR	1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.3:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+14.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+13.0	—	—	dBm
I_D	DC Current	34	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless noted)

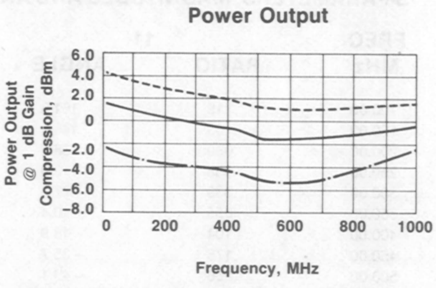
KEY:
+25°C ———
+85°C — — —
−55°C —·—·—



Gain



Noise Figure



Power Output

MAXIMUM RATINGS

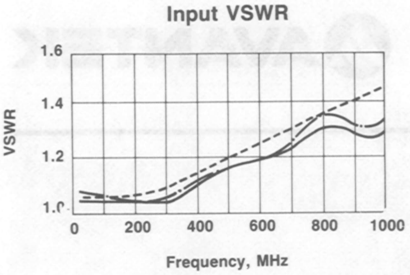
DC Voltage .... +17 Volts
Continuous RF Input Power .... +17 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +100°C
"R" Series Burn-In Temperature .... +100°C

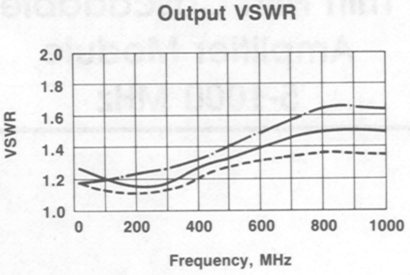
THERMAL CHARACTERISTICS

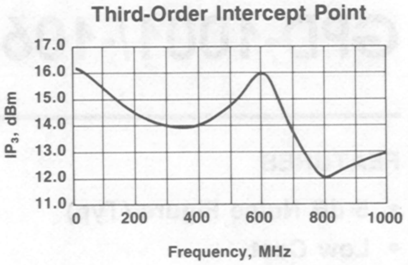
θ_{JC} [1] .... 240/240°C/W
Active Transistor Power Dissipation[1] .... 170/170 mW
Junction Temperature Above Case Temperature[1] .... 41/41°C

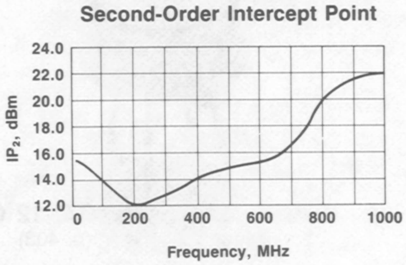
Note 1: Values refer to 1st and 2nd stage transistors respectively.

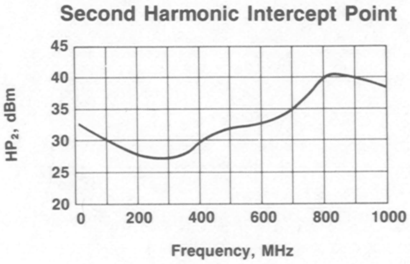
WEIGHT: (typical) — 1.5 grams











AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.06	37.36	–2.73	.00	1.13	46.24
150.0	1.06	37.39	–.81	.52	1.18	46.82
200.0	1.01	37.48	.99	.56	1.18	42.08
250.0	1.04	37.54	1.50	.59	1.19	49.53
300.0	1.03	37.59	2.09	.62	1.24	45.62
350.0	1.09	37.55	1.75	.67	1.26	42.90
400.0	1.08	37.53	.46	.69	1.31	46.05
450.0	1.12	37.58	–.54	.71	1.33	44.11
500.0	1.14	37.58	–2.72	.73	1.36	43,15

LINEARIZATION RANGE: 100.0 TO 500.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS
31.80 MA

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.023	–45.3	38.196	–13.4	–43.252	9.0	,092	–17.3
150.00	.041	–20.9	38.216	–21.2	–44.382	34.7	.075	–23.9
200.00	.022	–28.8	38.317	–28.5	–46.343	22.8	.076	–22.7
250.00	.041	–17.8	38.378	–36.1	–47.346	35.2	.080	–21.0
300.00	.023	16.3	38.387	–44.4	–45.052	36.7	.086	–21.8
350.00	.045	7.1	38.338	–53.1	–45.824	42.7	.103	–28.9
400.00	.048	–3.8	38.267	–62.4	–43.623	56.2	.120	–33.1
450.00	.061	19.3	38.156	–72.0	–44.366	45.5	.135	–41.0
500.00	.075	23.3	38.074	–81.7	–43.714	51.5	.145	–46.5
550.00	.080	17.2	37.911	–91.7	–43.756	48.8	.156	–52.7
600.00	.090	10.3	37.629	–101.3	–43.239	52.8	.169	–59.7
650.00	.102	–.7	37.189	–111.0	–42.263	57.5	.183	–64.9
700.00	.109	–5.5	36.756	–120.6	–41.282	57.4	.189	–70.8
750.00	.125	–5.3	36.237	–129.8	–41.768	56.3	.197	–77.2
800.00	.138	–9.8	35.565	–137.9	–41.268	59.4	.203	–82.8
850.00	.136	–12.8	34.947	–146.0	–40.664	64.0	.200	–85.7
900.00	.125	–20.5	34.202	–153.3	–40.543	62.8	.200	–89.3
950.00	.138	–20.8	33.535	–160.7	–40.261	62.7	.196	–91.2
1000.00	.134	–24.7	32.782	–167.3	–39.955	61.5	.196	–93.3
1100.00	.160	–26.9	31.349	–178.5	–39.750	67.7	.196	–95.0
1200.00	.179	–33.4	30.097	172.7	–38.885	67.8	.203	–94.3
1300.00	.225	–35.7	29.019	163.5	–39.074	62.2	.205	–97.2
1400.00	.223	–42.3	27.887	154.7	–38.360	65.4	.207	–97.9
1500.00	.233	–44.4	26.770	146.5	–38.217	64.2	.201	–96.5
1600.00	.267	–50.2	25.736	138.9	–38.559	67.4	.217	–95.3
1700.00	.288	–50.3	24.855	131.2	–38.686	65.5	.217	–91.5
1800.00	.311	–53.1	24.155	124.1	–36.668	64.8	.233	–91.4
1900.00	.328	–56.7	23.409	117.7	–39.288	67.0	.239	–86.8
2000.00	.355	–59.4	22.790	110.8	–39.861	68.5	.256	–88.3

REFERENCE PLANES = 8.65 8.65 17.30

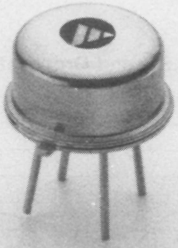
GPD-1001/-1061

Thin Film Cascadable Amplifier Module
5-1000 MHz

AVANTEK

FEATURES

- **5 dB Noise Figure (Typ)**
- **Low Cost**
- **Small Size**



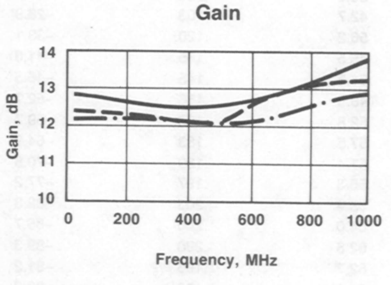
TO-12 Case
(p. 403)

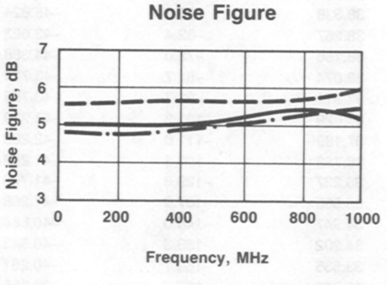
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

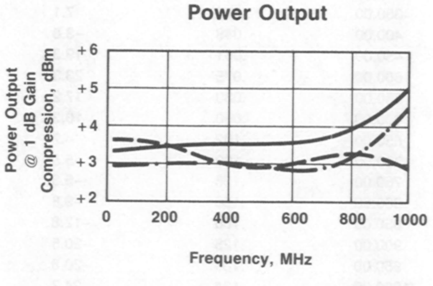
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	T_C = -55°- +85°C	Unit
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	12.5	12.0 Min.	11.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	5.0	—	—	dB
—	Reverse Isolation	18.0	—	—	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+0.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+12.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+18.0	—	—	dBm
I_D	DC Current	15	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
-55°C —·—·—







MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... -55°C to +125°C
Storage Temperature .... -62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

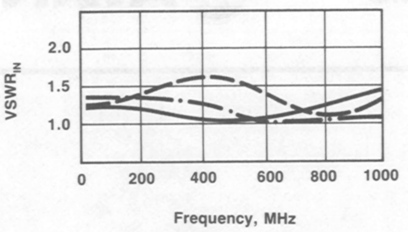
THERMAL CHARACTERISTICS*

θ_{JC} .... 160°C/W
Active Transistor Power Dissipation .... 81.6 mW
Junction Temperature Above Case Temperature .... 13°C
MTBF .... 1,639,228 (1001)/1,910,397 (1061) Hrs.

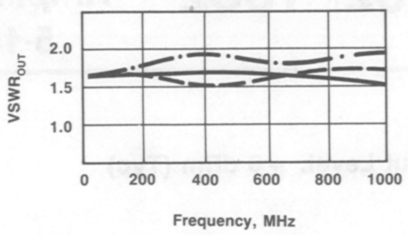
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams

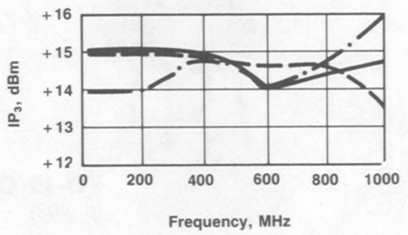
Input VSWR



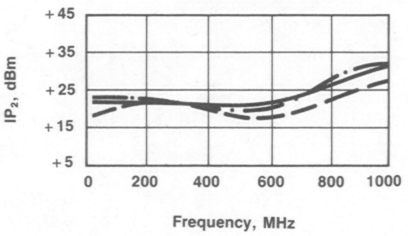
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.29	12.80	175.00	–1.27	.00	1.55	21.19
200.0	1.25	12.70	171.12	–.70	.15	1.57	20.80
300.0	1.20	12.70	165.90	–.76	.13	1.59	20.73
400.0	1.15	12.68	161.70	.19	.10	1.59	20.57
500.0	1.11	12.69	157.36	.98	.11	1.60	20.31
600.0	1.13	12.82	152.75	1.51	.14	1.58	20.06
700.0	1.18	12.91	148.43	2.34	.14	1.57	19.83
800.0	1.26	13.20	142.15	1.21	.17	1.54	19.55
900.0	1.33	13.44	135.24	–.56	.25	1.48	19.29
1000.0	1.40	13.89	125.84	–4.81	.33	1.48	18.85
1100.0	1.66	14.25	110.43		.49	1.60	18.52
1200.0	2.65	14.09	88.12		.66	1.95	19.60
1300.0	5.16	11.75	67.01		.53	2.26	21.99

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

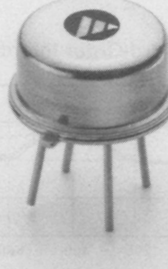
FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.126	176.0	12.781	175.4	–20.769	6.5	.216	.8
200.00	.109	170.2	12.735	171.2	–20.961	11.4	.222	3.4
300.00	.090	167.9	12.693	165.9	–20.665	18.5	.228	3.6
400.00	.070	176.0	12.683	161.8	–20.550	24.4	.229	3.1
500.00	.051	–165.9	12.662	157.5	–20.195	28.3	.232	.6
600.00	.059	–137.8	12.787	152.8	–20.108	32.5	.228	–2.0
700.00	.084	–125.1	12.899	148.5	–19.851	36.3	.224	–4.7
800.00	.115	–134.4	13.175	142.2	–19.505	38.1	.213	–8.0
900.00	.145	–153.4	13.447	135.5	–19.210	38.4	.198	–6.6
1000.00	.170	169.8	13.865	126.0	–18.813	37.5	.195	–.2
1100.00	.247	112.2	14.251	110.7	–18.550	32.7	.234	7.1
1200.00	.450	52.0	14.090	88.5	–19.649	25.2	.322	–.4
1300.00	.675	2.7	11.730	67.1	–21.993	21.1	.390	–19.1
1400.00	.789	–33.2	7.973	53.1	–23.851	29.5	.364	–40.5
1500.00	.831	–54.8	4.163	50.8	–24.626	37.0	.302	–53.1

GPD-1002/-1062 Thin Film Cascadable Amplifier Module 5-1000 MHz

AVANTEK

FEATURES

- **Medium Output Level: +6 dBm (Typ)**
- **Low Cost**
- **Small Size**



TO-12 Case
(p. 403)

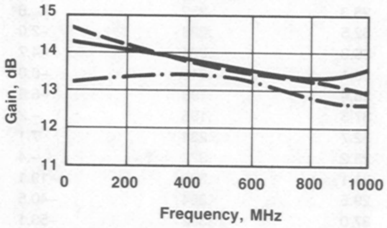
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		T_C = 25°C	T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	13.0	12.0 Min.	11.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	7.0	—	—	dB
—	Reverse Isolation	18.0			dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+6.0	—	—	dBm
—	Input VSWR	—	—	2.0:1 Max.	—
—	Output VSWR	—	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+16.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+19.0	—	—	dBm
I_D	DC Current	27		—	mA

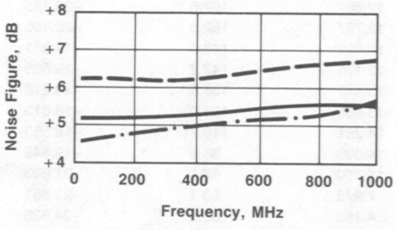
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
−55°C —·—·—

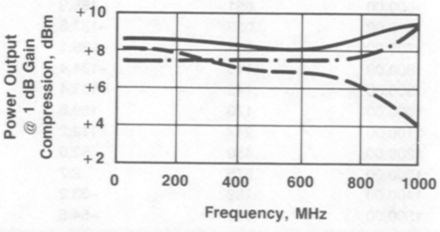
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

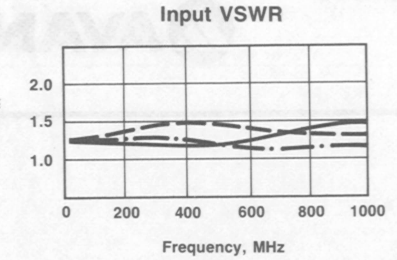
DC Voltage . . . . +17 Volts
Continuous RF Input Power . . . . +13 dBm
Operating Case Temperature . . . . −55°C to +125°C
Storage Temperature . . . . −62°C to +150°C
"R" Series Burn-In Temperature . . . . +125°C

THERMAL CHARACTERISTICS*

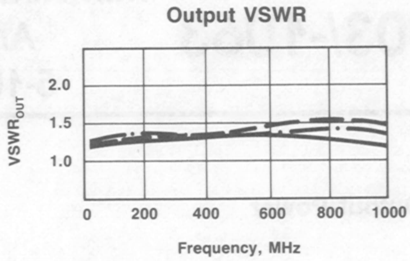
θ_{JC} . . . . 160°C/W
Active Transistor Power Dissipation . . . . 81.6 mW
Junction Temperature Above Case Temperature . . . . 13°C
MTBF . . . . 1,639,228 (1002)/1,882,476 (1062) Hrs.

*For further information, see High Reliability section.

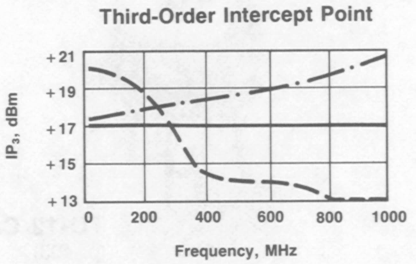
WEIGHT: (typical) — 1.5 grams



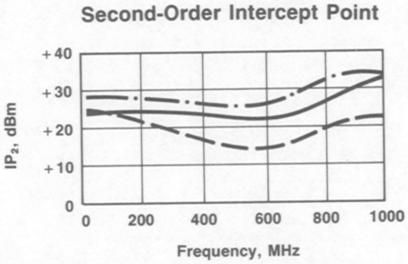
Input VSWR



Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.29	14.23	174.38	–.16	.00	1.26	24.09
200.0	1.26	14.06	167.94	–.52	.19	1.27	23.33
300.0	1.21	13.97	161.47	–.93	.16	1.29	23.49
400.0	1.17	13.83	156.06	–.27	.14	1.30	23.05
500.0	1.18	13.67	150.80	.53	.14	1.31	22.61
600.0	1.23	13.57	145.27	1.08	.16	1.30	22.14
700.0	1.30	13.44	139.93	1.82	.17	1.29	21.64
800.0	1.39	13.43	133.32	1.29	.18	1.26	21.23
900.0	1.44	13.41	125.77	–.18	.26	1.20	20.79
1000.0	1.49	13.53	115.90	–3.99	.33	1.18	19.94
1100.0	1.76	13.51	100.99		.48	1.25	19.43
1200.0	2.74	12.87	80.86		.59	1.43	19.96
1300.0	5.08	10.21	60.92		.44	1.57	21.81

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.130	177.2	14.212	174.2	–23.883	10.1	.114	1.0
200.00	.115	174.5	14.090	168.1	–23.830	14.4	.118	9.1
300.00	.094	177.6	13.974	161.6	–23.220	23.4	.127	9.4
400.00	.081	–168.4	13.831	156.2	–22.778	31.2	.130	9.0
500.00	.081	–150.6	13.638	150.9	–22.618	36.0	.134	6.5
600.00	.102	–139.1	13.535	145.2	–22.092	41.8	.132	3.1
700.00	.131	–138.6	13.423	139.9	–21.605	45.5	.127	–1.0
800.00	.162	–150.9	13.412	133.3	–21.127	48.1	.115	–6.2
900.00	.178	–171.3	13.416	126.0	–20.662	48.3	.097	–5.4
1000.00	.197	151.2	13.496	116.0	–19.983	47.6	.084	10.0
1100.00	.272	95.7	13.510	101.1	–19.447	42.2	.112	29.1
1200.00	.462	40.7	12.865	81.0	–20.066	34.7	.175	19.4
1300.00	.668	–4.2	10.191	60.9	–21.823	26.8	.225	–4.7
1400.00	.793	–37.1	6.343	51.1	–24.091	28.3	.213	–28.4
1500.00	.837	–58.2	2.570	50.1	–25.353	36.2	.174	–48.3

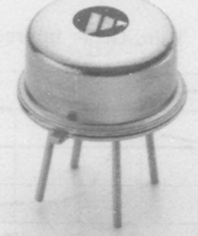
GPD-1003/-1063

Thin Film Cascadable Amplifier
5-1000 MHz

AVANTEK

FEATURES

- +14.0 dBm Output Power
- Low Cost
- Small Size



TO-12 Case
(p. 403)

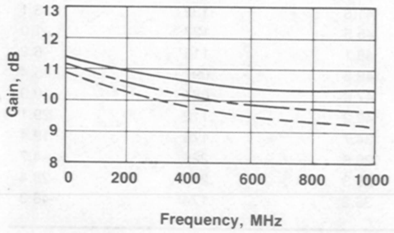
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	10.5	10.0 Min.	9.0 Min.	dB
—	Gain Flatness	±1.0	—	—	dB
NF	Noise Figure	7.0	—	—	dB
—	Reverse Isolation	18.0			dB
$P_{1 dB}$	Power Output @ + 1 dB Compression	+14.0	—	—	dBm
—	Input VSWR	1.50:1	—	2.0:1 Max.	—
—	Output VSWR	1.30:1	—	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+25.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+37.0	—	—	dBm
I_D	DC Current	55		—	mA

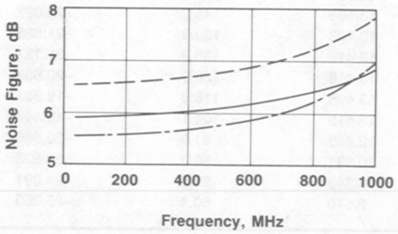
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

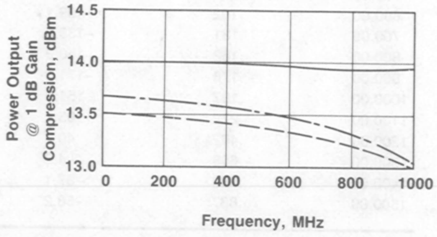
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

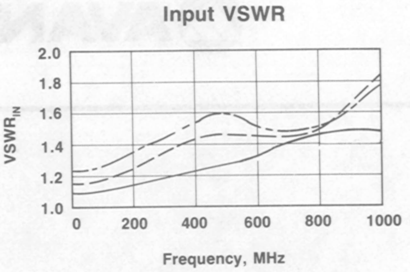
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

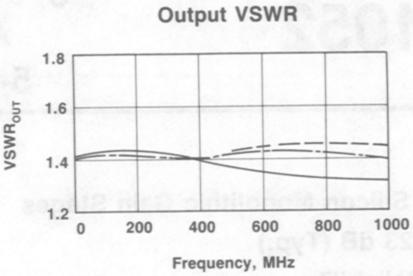
THERMAL CHARACTERISTICS*

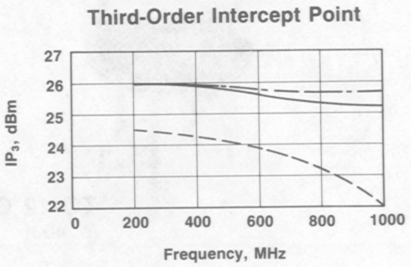
θ_{JC}	105°C/W
Active Transistor Power Dissipation	225 mW
Junction Temperature Above Case Temperature	23.7°C
MTBF	869,341 (1003)/2,101,101 (1063) Hrs.

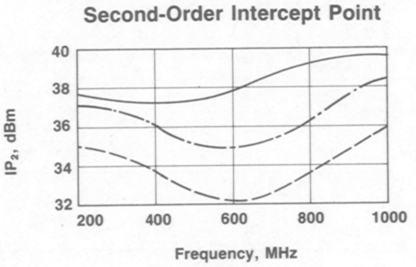
*For further information, see High Reliability section.

WEIGHT: (typical) — 1.5 grams


Input VSWR


Output VSWR


Third-Order Intercept Point


Second-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.13	11.32	161.40	–.60	.00	1.46	22.29
200.0	1.17	11.18	141.34	–1.28	.54	1.43	22.12
300.0	1.23	11.14	122.54	–.68	.51	1.39	21.89
400.0	1.27	10.98	104.21	.36	.51	1.34	21.62
500.0	1.31	10.84	86.05	1.58	.53	1.29	21.29
600.0	1.36	10.72	66.56	1.47	.52	1.26	21.00
700.0	1.41	10.74	47.59	1.88	.57	1.26	21.02
800.0	1.53	10.67	26.70	.38	.56	1.22	19.34
900.0	1.50	10.75	6.68	–.23	.59	1.24	18.98
1000.0	1.54	10.88	–16.41	–3.94	.00	1.28	18.61

LINEARIZATION RANGE: 100.0 TO 1000.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.053	–123.2	11.016	171.9	–21.498	11.5	.149	–9.5
200.00	.086	–119.4	11.120	167.0	–22.503	5.8	.125	–16.6
300.00	.082	–127.5	11.249	160.5	–20.865	25.2	.148	–22.0
400.00	.104	–130.2	10.924	154.6	–21.173	25.7	.139	–38.5
500.00	.113	–132.5	10.857	148.1	–21.142	33.8	.141	–49.3
600.00	.137	–146.1	10.755	141.8	–21.214	33.8	.136	–64.1
700.00	.144	–157.4	10.768	135.9	–20.690	39.1	.147	–77.9
800.00	.153	–169.4	10.778	127.8	–20.598	43.3	.156	–93.9
900.00	.186	169.2	10.973	120.2	–19.731	40.8	.157	–109.0
1000.00	.207	136.3	11.218	109.3	–18.887	36.1	.160	–128.3
1100.00	.293	88.5	11.458	95.4	–20.163	40.2	.165	–152.0
1200.00	.455	32.3	10.592	76.2	–19.339	31.5	.144	–175.6
1300.00	.646	–15.4	8.449	55.5	–19.985	24.1	.132	169.3
1400.00	.763	–50.0	5.442	43.9	–21.462	20.9	.133	154.4
1500.00	.820	–75.6	2.652	39.0	–22.083	25.1	.133	138.6
1600.00	.862	–94.2	.174	37.8	–22.710	30.6	.145	117.1
1700.00	.892	–109.5	–2.115	35.7	–24.469	22.8	.163	102.4

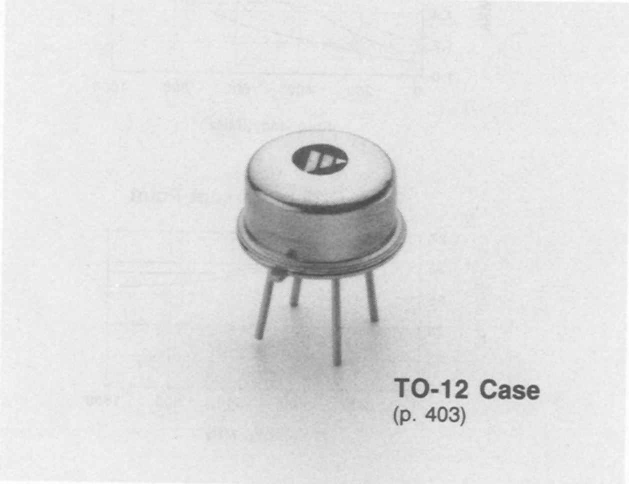
GPM-1052

High Gain Modular Amplifier 5-1000 MHz

AVANTEK

FEATURES

- **MODAMP™ Silicon Monolithic Gain Stages**
- **High Gain: 23 dB (Typ.)**
- **Increased Reliability**



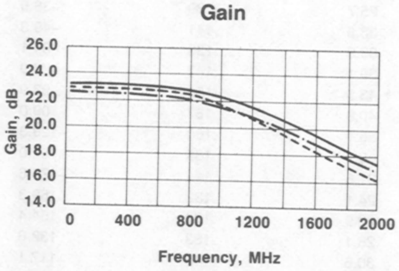
TO-12 Case
(p. 403)

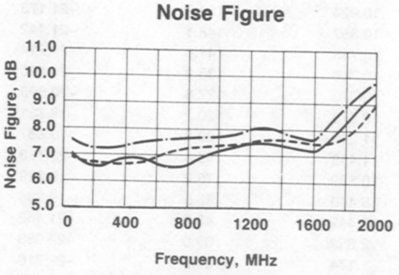
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

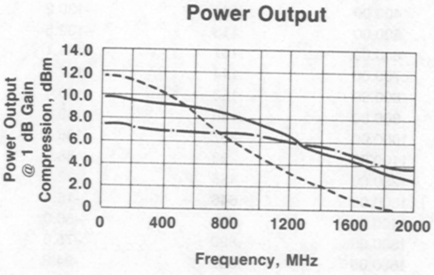
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +71°C	Unit
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	23.0	20.0 Min.	20.0 Min.	dB
—	Gain Flatness	±0.3	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	7.0	8.0 Max.	8.5 Max.	dB
—	Reverse Isolation	20.0	—	—	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+8.0	+5.0 Min.	+3.0 Min.	dBm
—	Input VSWR	1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+20.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+40.0	—	—	dBm
I_D	DC Current	60	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ———
+71°C — — —
−55°C —·—·—







MAXIMUM RATINGS

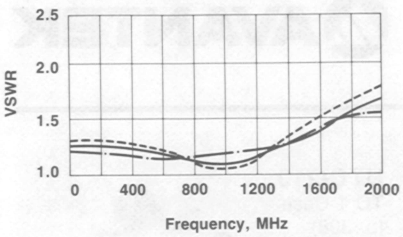
DC Voltage	+17 Volts
Continuous RF Input Power	+17 dBm
Operating Case Temperature	−55°C to +71°C
Storage Temperature	−62°C to +71°C
"R" Series Burn-In Temperature	+71°C

THERMAL CHARACTERISTICS

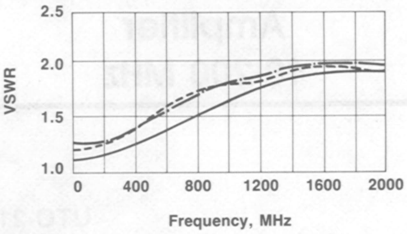
θ_{JC}	240/240°C/W
Active Transistor Power Dissipation	250/350 mW
Junction Temperature Above Case Temperature	60/84°C

WEIGHT: (typical) — 1.5 grams

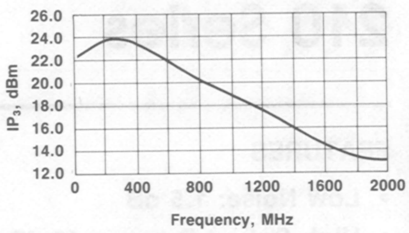
Input VSWR



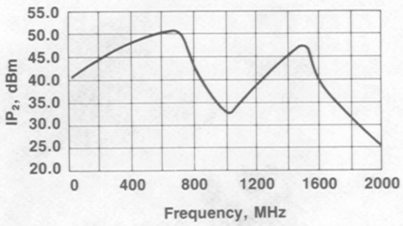
Output VSWR



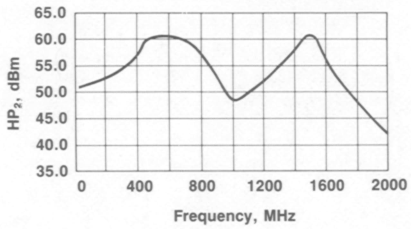
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEV	LOSS DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.27	23.10	−1.06	.26	.00	1.29	37.74
200.0	1.28	23.22	−.53	.05	.91	1.34	38.26
300.0	1.26	23.26	.50	−.08	.88	1.38	40.19
400.0	1.23	23.15	.65	−.04	.91	1.45	37.94
500.0	1.20	23.07	.27	−.05	.93	1.51	39.22
600.0	1.17	23.06	.08	−.12	.91	1.57	38.89
700.0	1.14	22.95	.18	−.10	.91	1.62	37.90
800.0	1.11	22.84	.02	−.08	.92	1.68	37.89
900.0	1.10	22.66	−.35	.01	.91	1.75	38.38
1000.0	1.08	22.29	−.49	.29	.92	1.80	38.80

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS
60.60 MA

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.120	174.2	23.188	−10.3	−36.001	.5	.138	−21.9
150.00	.122	178.8	23.284	−16.1	−41.210	3.6	.137	−30.0
200.00	.125	−179.1	23.211	−21.3	−38.986	−1.5	.148	−32.1
250.00	.120	−179.4	23.233	−26.5	−37.965	22.7	.150	−36.4
300.00	.112	−179.5	23.231	−32.0	−41.795	9.6	.160	−41.9
350.00	.108	−179.7	23.161	−37.7	−38.308	16.8	.164	−46.9
400.00	.110	−167.9	23.149	−42.1	−40.926	18.2	.195	−55.3
450.00	.101	−176.9	23.117	−49.1	−38.585	11.8	.193	−58.0
500.00	.093	−178.9	23.107	−55.2	−39.673	17.6	.207	−59.7
550.00	.086	−177.4	23.091	−61.5	−38.490	13.9	.219	−62.7
600.00	.083	−178.9	23.104	−67.3	−37.638	11.4	.230	−66.0
650.00	.075	−174.4	23.111	−73.7	−38.089	23.6	.237	−68.5
700.00	.069	−175.7	23.088	−79.6	−38.919	16.3	.238	−72.7
750.00	.061	−174.3	23.024	−85.5	−38.214	18.2	.248	−78.4
800.00	.054	−169.5	22.927	−91.9	−40.107	25.0	.262	−82.0
850.00	.047	−162.8	22.841	−98.1	−38.402	21.8	.270	−84.7
900.00	.043	−149.6	22.708	−104.6	−40.210	17.2	.277	−86.8
950.00	.042	−142.4	22.484	−110.7	−39.685	20.7	.283	−90.2
1000.00	.042	−134.0	22.286	−116.3	−37.621	38.5	.291	−91.8
1100.00	.049	−97.3	21.873	−127.2	−40.257	21.1	.282	−95.3
1200.00	.078	−88.2	21.491	−138.8	−40.780	24.2	.297	−101.7
1300.00	.104	−84.8	21.054	−150.2	−38.288	25.6	.305	−106.4
1400.00	.128	−85.5	20.596	−160.5	−37.806	33.2	.319	−109.9
1500.00	.151	−85,4	20.037	−170.3	−39.309	32.5	.311	−114.5
1600.00	.173	−89.0	19.396	179.8	−38.274	32.4	.324	−117.0
1700.00	.193	−89.4	18.854	170.2	−42.761	24.8	.316	−118.6
1800.00	.213	−94.3	18.377	160.2	−41.211	24.4	.327	−121.0
1900.00	.213	−92.2	17.899	152.1	−44.840	38.0	.311	−121.1
2000.00	.236	−96.2	17.535	143.7	−43.128	31.0	.315	−122.4

REFERENCE PLANES = 8.70 8.70 17.40

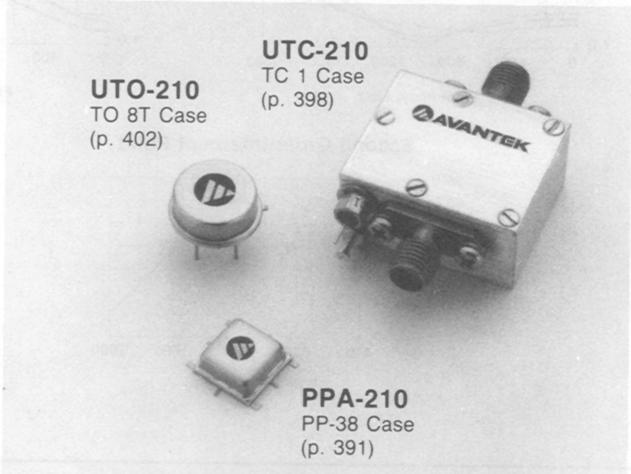
210 Series

Thin Film Cascadable Amplifier 10-200 MHz

AVANTEK

FEATURES

- **Low Noise: 1.5 dB**
- **High Output Power +13 dBm**
- **Low Current Drain: 15 mA**



UTC-210
TC 1 Case
(p. 398)

UTO-210
TO 8T Case
(p. 402)

PPA-210
PP-38 Case
(p. 391)

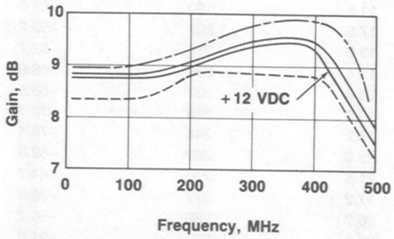
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°-50°C$	$T_C = -55°-+85°C$	Unit
BW	Frequency Range	10-200	10-200	10-200	MHz
GP	Small Signal Gain	9.0	8.0 Min.	7.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	1.5	2.0 Max.	2.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+13	+11.0 Min.	+11.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+29.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+40.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+45.0	—	—	dBm
I_D	DC Current	15	—	—	mA

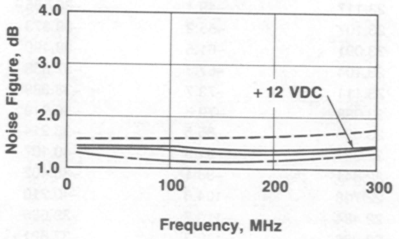
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—

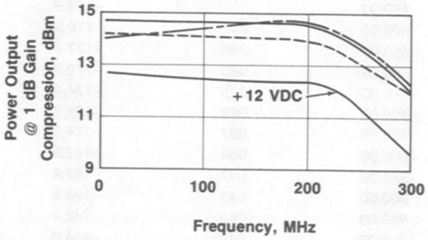
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

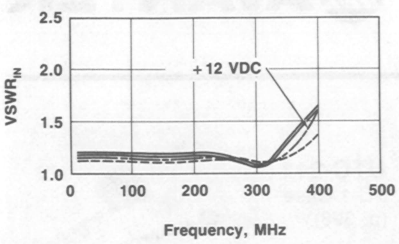
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

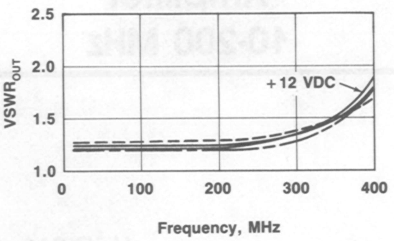
THERMAL CHARACTERISTICS*

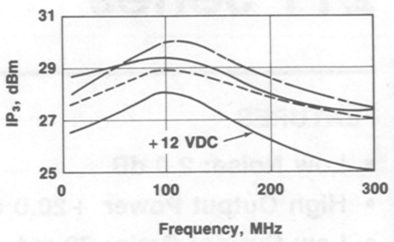
θ_{JC} .... 120°C/W
Active Transistor Power Dissipation .... 77 mW
Junction Temperature Above Case Temperature .... 9°C
MTBF .... 833,706 Hrs.

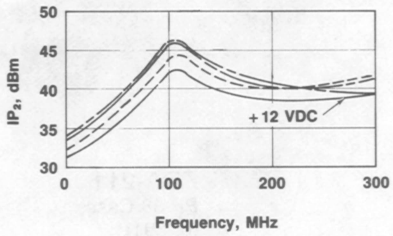
*For further information, see High Reliability section.

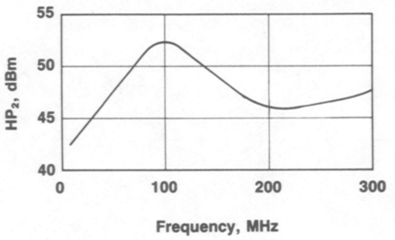
WEIGHT: (typical) PPA—0.5 grams; UTO—2.1 grams; UTC—21.5 grams


Input VSWR


Output VSWR


Third-Order Intercept Point


Second-Order Intercept Point


Second Harmonic Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.17	8.80	−18.96	−1.14	.00	1.16	11.24
120.0	1.19	8.85	−22.60	−.53	53	1.17	11.44
140.0	1.21	8.89	−26.53	−.22	.55	1.17	11.43
160.0	1.22	8.94	−30.50	.04	.50	1.18	11.55
180.0	1.23	9.00	−33.77	1.02	.52	1.18	11.64
200.0	1.22	9.08	−37.96	1.09	.60	1.18	11.81
220.0	1.21	9.15	−42.38	.91	.61	1.17	11.90
240.0	1.18	9.22	−46.70	.83	.63	1.17	12.11
260.0	1.14	9.29	−51.51	.26	.69	1.17	12.28
280.0	1.09	9.39	−56.59	−.57	.73	1.18	12.49
300.0	1.04	9.46	−61.96	−1.70	.81	1.21	12.73
400.0	1.62	9.55	−94.33		.99	1.77	14.61
500.0	3.60	7.93	−131.04		.95	3.41	18.63
600.0	7.61	4.61	−159.21		.66	5.84	24.82
700.0	13.19	.90	−179.04		.47	7.85	29.91
800.0	18.54	−2.13	165.58		.36	9.00	30.40
900.0	24.65	−4.88	153.02		.34	9.29	27.45
1000.0	27.86	−7.37	143.66		.00	9.25	24.15

LINEARIZATION RANGE: 100.0 TO 300.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.077	38.4	8.779	−18.9	−11.284	−17.0	.075	128.5
120.00	.087	36.8	8.852	−22.7	−11.336	−21.1	.077	120.9
140.00	.096	36.6	8.890	−26.6	−11.389	−24.8	.080	114.7
160.00	.100	34.5	8.948	−30.5	−11.544	−28.3	.083	111.4
180.00	.102	31.1	9.019	−34.0	−11.665	−31.7	.084	108.1
200.00	.100	27.7	9.093	−38.2	−11.779	−35.5	.083	105.6
220.00	.094	22.1	9.153	−42.4	−11.942	−39.2	.083	106.7
240.00	.083	16.3	9.233	−46.9	−12.118	−43.3	.081	110.4
260.00	.066	8.2	9.300	−51.6	−12.318	−47.9	.085	117.0
280.00	.046	−2.2	9.385	−56.7	−12.449	−52.4	.091	125.9
300.00	.019	−24.4	9.472	−62.1	−12.751	−56.8	.102	133.6
400.00	.237	152.1	9.566	−94.5	−14.552	−85.2	.282	139.5
500.00	.564	112.2	7.924	−131.1	−18.699	−115.4	.548	110.4
600.00	.769	79.1	4.608	−159.0	−24.810	−140.5	.706	79.6
700.00	.860	56.1	.914	−179.1	−29.931	−161.1	.774	56.3
800.00	.904	39.1	−2.128	165.5	−30.400	172.9	.797	38.7
900.00	.924	25.5	−4.839	153.3	−27.485	154.0	.806	25.3
1000.00	.930	12.4	−7.371	143.6	−24.167	139.2	.805	13.2

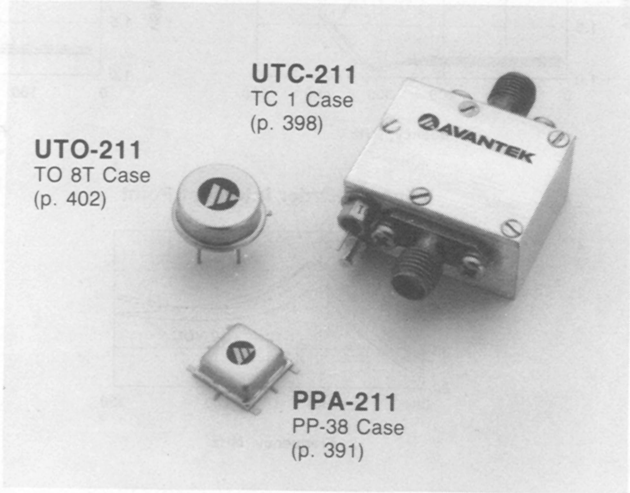
211 Series

Thin Film Cascadable Amplifier 10-200 MHz

AVANTEK

FEATURES

- **Low Noise: 2.0 dB**
- **High Output Power +20.0 dBm**
- **Low Current Drain: 30 mA**



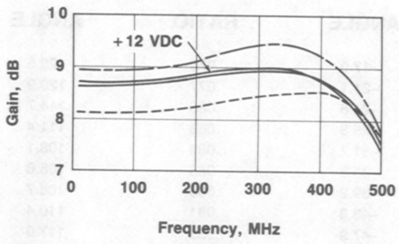
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	10-200	10-200	10-200	MHz
GP	Small Signal Gain	8.5	7.5 Min.	7.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	2.0	2.7 Max.	3.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+20.0	+17.0 Min.	+16.0 Min.	dBm
—	Input VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+31.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+45.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+51.0	—	—	dBm
I_D	DC Current	30	—	—	mA

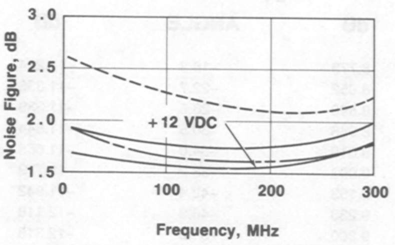
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

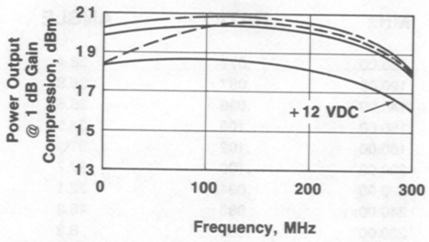
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

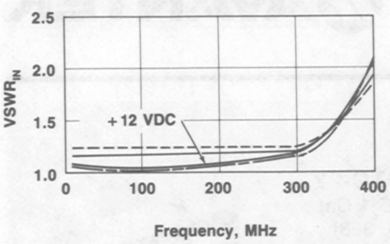
DC Voltage .... +17 Volts
Continuous RF Input Power .... +17 dBm
Operating Case Temperature .... -55°C to +125°C
Storage Temperature .... -62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

THERMAL CHARACTERISTICS*

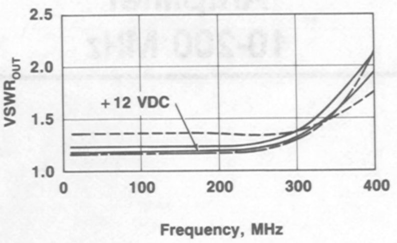
θ_{JC} .... 120°C/W
Active Transistor Power Dissipation .... 250 mW
Junction Temperature Above Case Temperature .... 30°C
MTBF .... 770,324 Hrs.

*For further information, see High Reliability section.

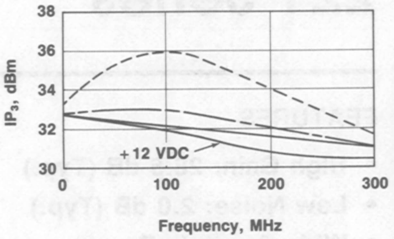
WEIGHT: (typical) PPA—0.5 grams; UTO—2.1 grams; UTC—21.5 grams



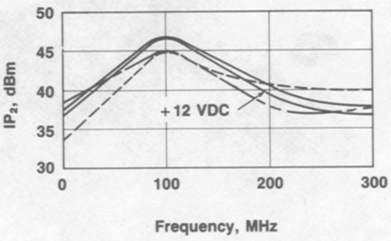
Input VSWR



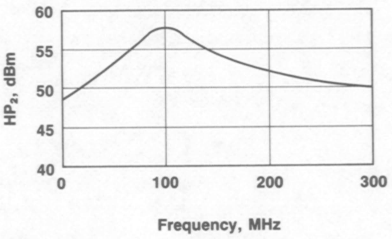
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.11	8.58	−17.31	−.89	.00	1.25	11.43
120.0	1.11	8.63	−20.98	−.42	52	1.24	11.48
140.0	1.11	8.65	−24.84	−.14	.55	1.24	11.61
160.0	1.11	8.68	−28.96	−.12	.50	1.24	11.71
180.0	1.10	8.72	−32.09	.87	.50	1.24	11.77
200.0	1.09	8.75	−36.20	.89	.58	1.23	11.94
220.0	1.08	8.81	−40.52	.70	.58	1.23	11.99
240.0	1.07	8.85	−44.62	.73	.61	1.24	12.21
260.0	1.08	8.89	−49.23	.25	.66	1.25	12.40
280.0	1.12	8.94	−54.14	−.52	.69	1.26	12.63
300.0	1.18	8.96	−59.11	−1.35	.75	1.30	12.89
400.0	1.94	8.87	−88.75		.89	1.82	14.80
500.0	4.24	7.32	−121.94		.88	3.25	19.03
600.0	9.41	4.25	−148.67		.63	5.57	26.37
700.0	18.23	.59	−167.70		.45	7.59	35.31
800.0	28.35	−2.64	178.14		.33	8.80	42.12
900.0	42.46	−5.62	166.62		.31	9.68	44.61
1000.0	54.08	−8.68	157.69		.00	9.86	35.60

LINEARIZATION RANGE: 100.0 TO 300.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.050	76.5	8.598	−17.3	−11.351	−15.1	.106	135.2
120.00	.053	71.3	8.661	−21.1	−11.420	−18.9	.106	131.4
140.00	.053	69.4	8.671	−24.9	−11.506	−22.5	.107	128.7
160.00	.051	68.6	8.720	−28.8	−11.658	−26.1	.107	125.6
180.00	.047	70.4	8.767	−32.2	−11.753	−29.9	.106	123.2
200.00	.043	75.3	8.819	−36.3	−11.884	−33.5	.104	123.0
220.00	.036	84.0	8.839	−40.5	−12.030	−37.6	.103	124.2
240.00	.031	106.8	8.882	−44.8	−12.203	−41.3	.105	127.6
260.00	.038	138.1	8.922	−49.3	−12.355	−45.6	.111	131.6
280.00	.055	154.5	8.975	−54.1	−12.578	−50.2	.119	137.1
300.00	.083	160.4	9.008	−59.2	−12.859	−54.5	.133	141.7
400.00	.324	145.0	8.899	−88.9	−14.795	−80.8	.295	144.8
500.00	.621	112.8	7.324	−121.8	−19.034	−107.2	.534	120.3
600.00	.813	81.9	4.218	−148.3	−26.501	−124.8	.700	92.5
700.00	.900	59.2	.594	−167.3	−35.447	−117.1	.775	69.6
800.00	.942	41.9	−2.592	178.4	−41.899	−101.8	.799	52.6
900.00	.959	27.8	−5.632	167.1	−44.633	−166.4	.812	39.2
1000.00	.965	14.2	−8.691	158.3	−35.760	149.7	.815	28.0

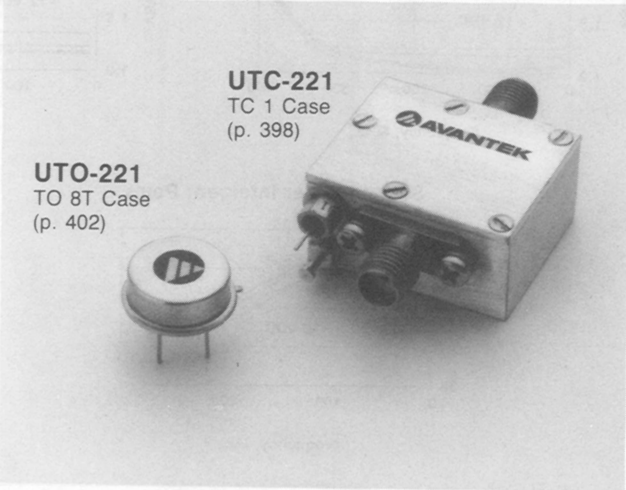
221 Series

Thin Film Cascadable Amplifier
10-200 MHz

AVANTEK

FEATURES

- **High Gain: 28.5 dB (Typ.)**
- **Low Noise: 2.0 dB (Typ.)**
- **Wide Dynamic Range**



UTC-221
TC 1 Case
(p. 398)

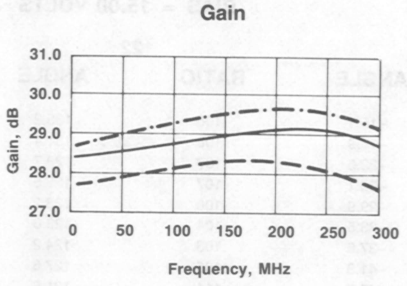
UTO-221
TO 8T Case
(p. 402)

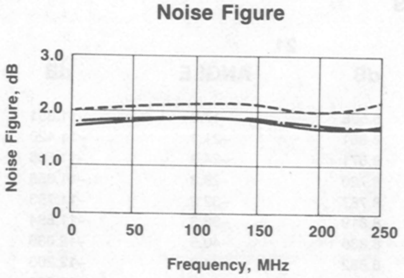
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

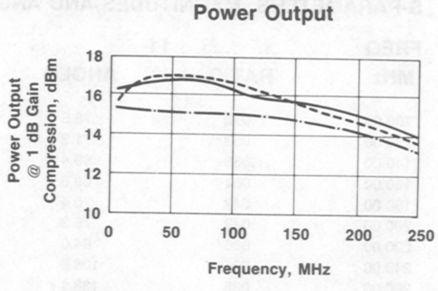
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	10-200	10-200	10-200	MHz
GP	Small Signal Gain	28.5	27.0 Min.	26.0 Min.	dB
—	Gain Flatness	±0.3	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	2.0	2.5 Max.	3.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+15.5	+13.5 Min.	+13.0 Min.	dBm
—	Input VSWR	1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+27.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+32.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+37.0	—	—	dBm
I_D	DC Current	29	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ———
+85°C — — —
−55°C —·—·—







MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

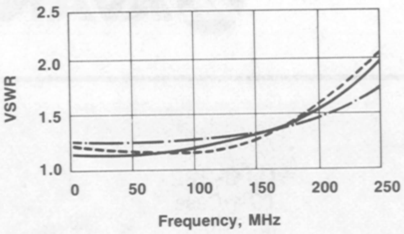
THERMAL CHARACTERISTICS*

θ_{JC} .... 105°C/W
Active Transistor Power Dissipation .... 242 mW
Junction Temperature Above Case Temperature .... 25°C
MTBF .... 1,366,226 Hrs.

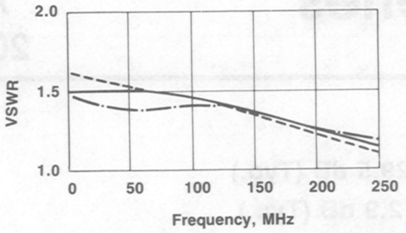
*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams

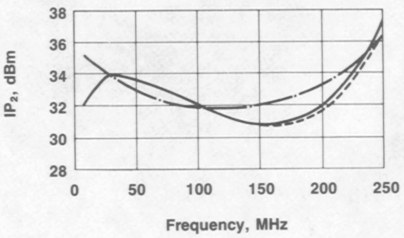
Input VSWR



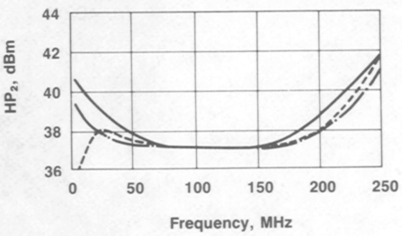
Output VSWR



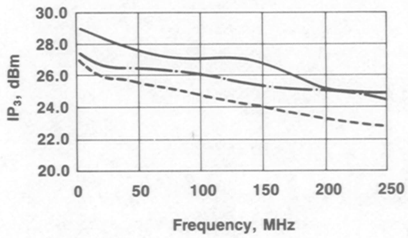
Second-Order Intercept Point



Second Harmonic Intercept Point



Third-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.19	28.63	155.64	−.46	.00	1.40	33.60
200.0	1.59	29.04	125.98	−.34	.91	1.24	33.65
300.0	2.56	28.84	89.26	—	1.12	1.25	35.19

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**
28.60 MA

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.090	83.2	28.565	155.6	−33.309	−10.2	.173	152.4
200.00	.226	21.1	28.970	125.6	−33.321	−22.3	.111	144.3
300.00	.450	−24.3	28.762	89.4	−34.917	−40.8	.115	−179.8
400.00	.595	−67.3	26.847	49.6	−37.789	−39.1	.273	163.5
500.00	.638	−97.9	23.130	19.2	−38.848	−37.3	.375	131.7
600.00	.632	−114.5	18.891	−3.0	−37.272	−39.3	.452	104.1
700.00	.657	−125.5	14.894	−3.1	−38.161	−44.3	.437	71.0
800.00	.615	−134.3	13.678	−17.8	−36.656	−48.0	.399	57.2
900.00	.576	−141.3	11.210	−31.3	−36.566	−55.8	.417	41.4
1000.00	.560	−146.7	8.679	−42.9	−36.094	−64.1	.415	25.5
1100.00	.550	−150.9	6.362	−52.6	−35.862	−71.9	.424	10.6
1200.00	.546	−152.2	4.307	−61.2	−36.379	−81.2	.420	−3.1
1300.00	.535	−153.5	2.254	−69.1	−36.077	−89.5	.418	−15.4
1400.00	.523	−154.2	.082	−78.8	−36.625	−96.0	.415	−28.2
1500.00	.513	−155.2	−1.910	−88.2	−37.139	−100.0	.404	−39.2

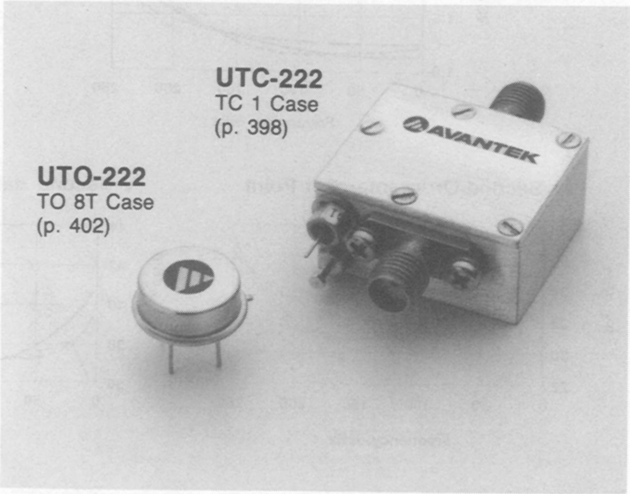
222 Series

Thin Film Cascadable Amplifier
20-200 MHz

AVANTEK

FEATURES

- **High Gain: 29.5 dB (Typ.)**
- **Low Noise: 2.9 dB (Typ.)**
- **Wide Dynamic Range**


UTC-222
TC 1 Case
(p. 398)

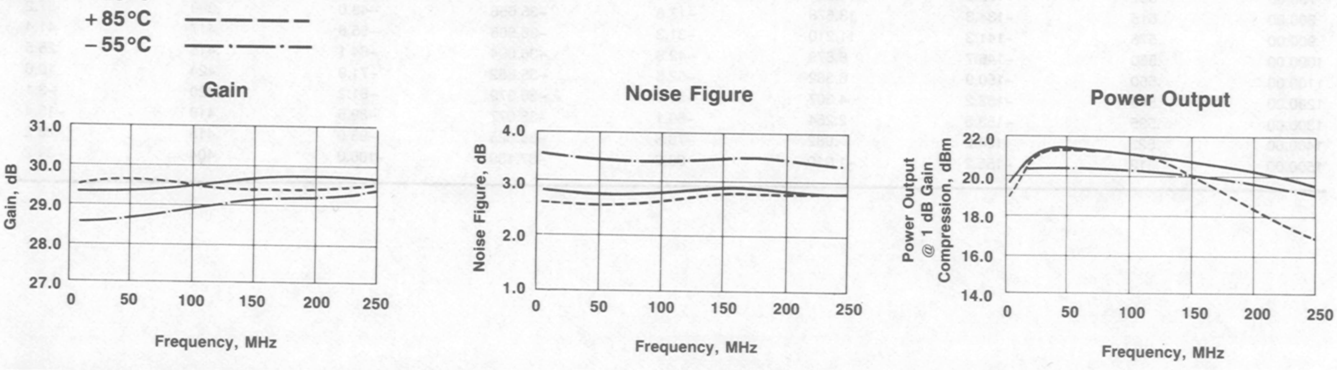
UTO-222
TO 8T Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	T_C = −55°- +85°C	Unit
BW	Frequency Range	20-200	20-200	20-200	MHz
GP	Small Signal Gain	29.5	28.0 Min.	27.0 Min.	dB
—	Gain Flatness	±0.3	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	2.9	3.6 Max.	4.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+21.0	+18.0[1] Min.	+17.0[2] Min.	dBm
—	Input VSWR	2.0:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	2.0:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+32.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+34.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+36.0	—	—	dBm
I_D	DC Current	47	—	—	mA

NOTE 1: Power Out 20 to 100 MHz = +20.0.
NOTE 2: Power Out 20 to 100 MHz = +19.0

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)



MAXIMUM RATINGS

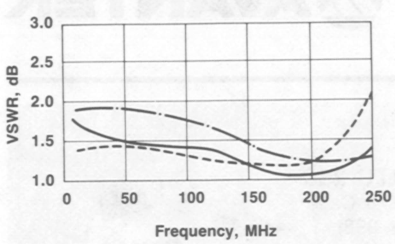
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +115°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+115°C

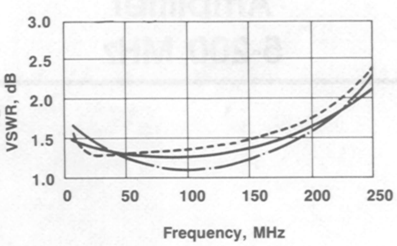
THERMAL CHARACTERISTICS*

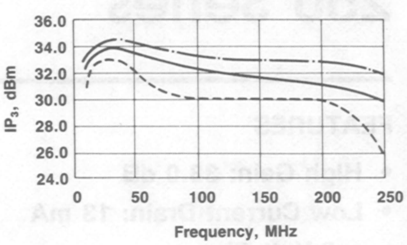
θ_{JC}	87°C/W
Active Transistor Power Dissipation	430 mW
Junction Temperature Above Case Temperature	37°C
MTBF	1,348,926 Hrs.

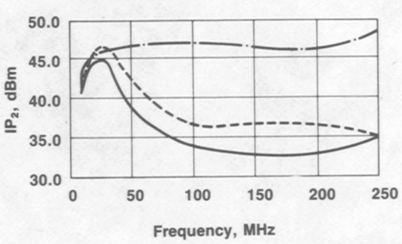
*For further information, see High Reliability section.

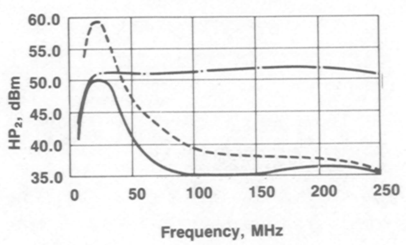
WEIGHT: (typical (UTO—2.1 grams; UTC—21.5 grams


Input VSWR


Output, VSWR


Third-Order Intercept Point


Second-Order Intercept Point


Second Harmonic

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.44	29.47	152.06	.00	.00	1.23	–29.47
200.0	1.03	29.84	116.24	.00	1.07	1.56	–29.84
300.0	1.80	28.89	74.68	—	1.09	2.97	–28.89

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS
47.00 MA

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.178	160.7	29.553	151.9	–34.660	–21.5	.114	96.6
200.00	.015	3.7	29.832	116.0	–34.933	–41.3	.221	–22.2
300.00	.292	–78.7	28.874	74.6	–36.727	–73.4	.494	–87.3
400.00	.493	–109.3	26.267	38.0	–39.855	–97.8	.667	–133.1
500.00	.579	–128.4	22.825	10.2	–45.535	–114.5	.722	–167.1
600.00	.612	–139.7	19.592	–13.4	–53.626	–122.6	.716	163.4
700.00	.662	–148.2	15.363	–27.5	–54.137	100.0	.584	132.7
800.00	.622	–156.0	14.581	–38.6	–44.844	–1.9	.512	122.9
900.00	.595	–159.0	12.450	–58.9	–43.508	–35.6	.491	96.1
1000.00	.580	–160.2	9.873	–78.5	–42.982	–51.0	.451	65.2
1100.00	.572	–160.7	7.187	–95.9	–42.690	–81.0	.414	32.6
1200.00	.568	–159.0	4.041	–110.8	–40.950	–99.6	.408	–1.1
1300.00	.595	–157.6	.257	–123.5	–40.114	–120.8	.432	–31.6
1400.00	.619	–156.7	–4.008	–131.5	–39.620	–138.1	.467	–55.6
1500.00	.657	–156.2	–8.115	–127.7	–39.040	–153.8	.509	–76.8

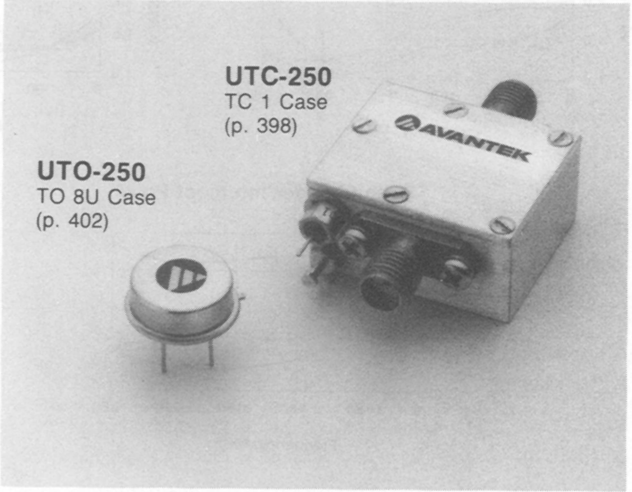
250 Series

Thin Film Cascadable Amplifier
5-200 MHz

AVANTEK

FEATURES

- **High Gain: 33.0 dB**
- **Low Current Drain: 13 mA**
- **+5 Volt Bias**


UTC-250
TC 1 Case
(p. 398)

UTO-250
TO 8U Case
(p. 402)

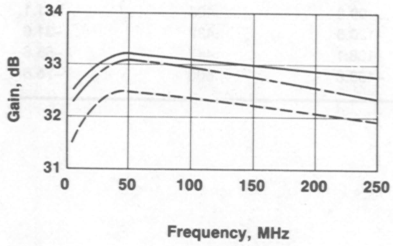
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +5 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	Guaranteed Specifications $T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	5-200	5-200	5-200	MHz
GP	Small Signal Gain	33.0	30.0 Min.	29.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	3.5	4.0 Max.	5.0 Max.	dB
$P_{1\ dB}$	Power Output @ +1 dB Compression	−1.4	−3.0 Min.	−4.0 Min.	dBm
—	Input VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	
IP_3	Two Tone 3rd Order Intercept Point	+9.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+13.0	—	—	dBm
I_D	DC Current	13	—	—	mA

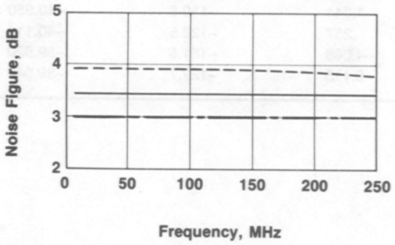
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +5 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—

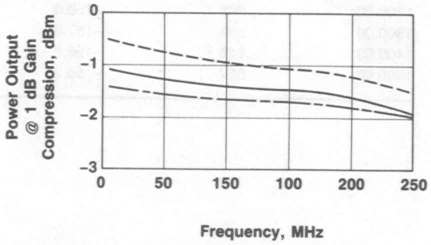
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage .... +12 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

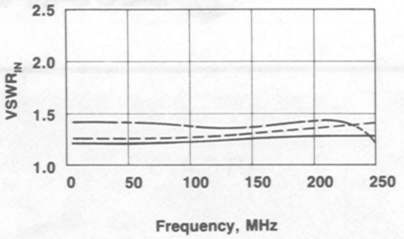
THERMAL CHARACTERISTICS*

θ_{JC} .... 155/155°C/W
Active Transistor Power Dissipation .... 12.5/18.7 mW
Junction Temperature Above Case Temperature ...... 2/3°C
MTBF .... 661,159 Hrs.

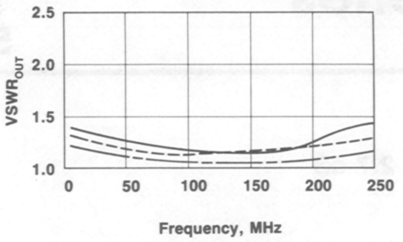
*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams

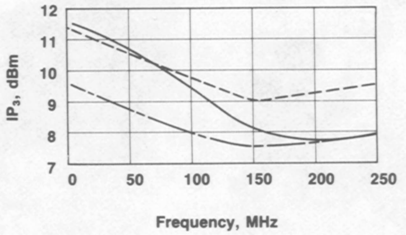
Input VSWR



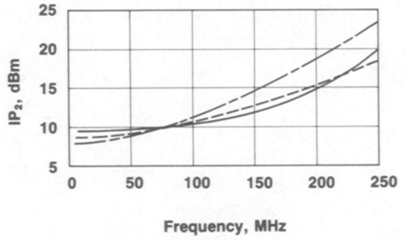
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 5.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.13	33.33	–31.08	–.63	.00	1.20	40.25
120.0	1.13	33.20	–35.74	1.12	.89	1.12	36.00
140.0	1.16	33.25	–43.90	–.61	.97	1.10	45.26
160.0	1.18	33.27	–49.65	.05	.84	1.13	43.12
180.0	1.26	33.16	–55.97	.15	.91	1.14	33.54
200.0	1.25	33.18	–62.70	–.14	.89	1.21	40.96
220.0	1.21	32.99	–68.84	.13	.87	1.24	42.47
240.0	1.23	32.87	–75.25	.14	.92	1.31	45.19
260.0	1.27	32.87	–82.04	–.21	.94	1.38	44.02
280.0	1.31	32.72	–88.86		.94	1.44	36.08
300.0	1.30	32.71	–95.62		.99	1.55	42.24
400.0	1.52	31.92	–132.74		1.06	2.32	45.41
500.0	1.81	29.98	–172.16		1.00	3.37	45.20
600.0	1.93	26.34	155.52		.74	3.43	47.63
700.0	1.88	22.49	134.35		.53	2.99	41.25
800.0	1.82	19.62	117.69		.00	2.60	38.98

LINEARIZATION RANGE: 100.0 TO 260.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 5.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.108	147.9	33.146	–31.0	–46.374	135.9	.039	–142.6
150.00	.085	126.4	33.095	–46.9	–38.261	48.6	.059	–118.1
200.00	.128	103.8	32.990	–61.9	–37.389	47.9	.097	–172.4
250.00	.116	70.4	32.736	–78.1	–41.684	23.8	.141	170.4
300.00	.138	45.2	32.584	–95.6	–45.391	–31.3	.217	146.8
400.00	.232	–8.0	31.862	–132.7	–45.308	42.4	.396	106.0
500.00	.315	–62.8	29.920	–172.5	–43.993	–37.3	.546	64.1
600.00	.337	–105.1	26.304	155.3	–69.103	140.9	.551	28.7
700.00	.316	–132.3	22.407	134.2	–44.944	109.1	.501	5.6
800.00	.302	–143.8	19.569	117.6	–38.947	103.9	.451	–6.6
900.00	.326	–149.4	17.191	100.2	–37.571	81.9	.438	–10.8
1000.00	.409	–158.5	14.732	79.3	–36.765	76.6	.475	–16.0
1100.00	.465	–176.0	11.304	56.6	–41.182	80.00	.519	–23.8
1200.00	.510	167.8	7.386	39.5	–44.597	75.6	.531	–32.2
1300.00	.519	153.4	2.577	29.7	–41.102	114.3	.532	–39.7
1400.00	.516	139.5	–2.830	26.3	–40.331	110.9	.532	–45.6
1500.00	.500	127.9	–8.145	34.7	–37.673	126.1	.536	–50.0

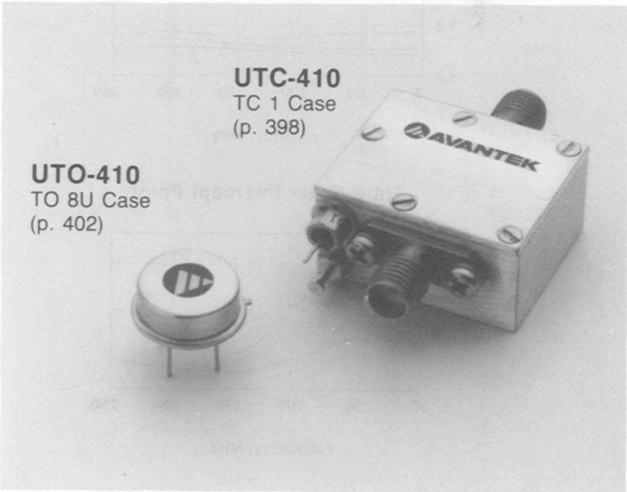
410 Series

Thin Film Cascadable Amplifier
5-400 MHz

AVANTEK

FEATURES

- **Low Noise: 2.7 dB**


UTC-410
TC 1 Case
(p. 398)

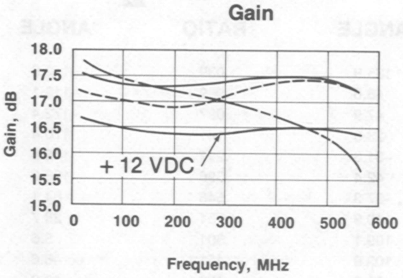
UTO-410
TO 8U Case
(p. 402)

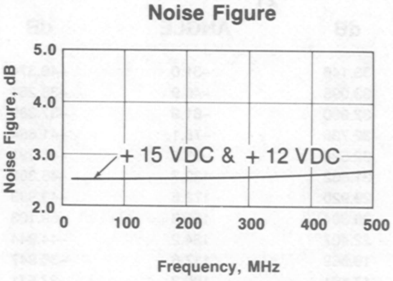
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

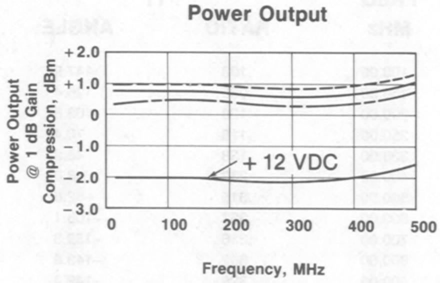
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	5-400	5-400	5-400	MHz
GP	Small Signal Gain	17.0	15.0 Min.	15.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	2.7	3.0 Max.	3.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+0.5	−2.0 Min.	−3.0 Min.	dBm
—	Input VSWR	<1.8:1	2.0:1 Max.	2.2:1 Max.	—
—	Output VSWR	<1.6:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+8.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+28.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+18.0	—	—	dBm
I_D	DC Current	10	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

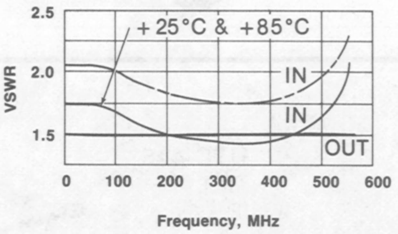
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	105°C/W
Active Transistor Power Dissipation	67 mW
Junction Temperature Above Case Temperature	7°C
MTBF	828,656 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams



VSWR

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	FLAT dB	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.69	17.39	147.77	– 5.69	– 4.04	.06	—	1.51	23.07
150.0	1.59	17.28	133.10	– 1.67	– .64	.16	.86	1.52	22.97
200.0	1.49	17.31	116.89	.81	1.23	.14	.95	1.49	22.68
250.0	1.39	17.33	99.01	1.63	1.43	.06	.96	1.50	22.64
300.0	1.33	17.51	52.39	3.71	2.89	– .06	.98	1.49	22.49
350.0	1.34	17.50	63.82	3.83	2.39	– .05	1.04	1.53	22.42
400.0	1.40	17.58	45.07	3.79	1.73	– .12	1.07	1.53	22.29
450.0	1.54	17.61	25.35	2.77	.09	– .16	1.19	1.53	21.69
500.0	1.79	17.49	2.11	– 1.78	– 5.08	– .04	1.32	1.54	22.32
550.0	2.16	17.06	– 22.23	– 7.42	—	—	1.43	1.50	22.09
600.0	2.97	16.03	– 49.43	—	—	—	1.45	1.37	23.18
LINEARIZATION RANGE:				100.0 TO 550.0	100.0 TO 500.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
100.00	.202	166.7	7.432	145.8	.073	– 10.6	.176	163.1
200.00	.154	160.3	7.326	115.3	.074	– 24.3	.169	148.1
300.00	.121	168.4	7.389	81.6	.077	– 39.8	.171	135.8
400.00	.152	168.2	7.395	45.6	.077	– 58.4	.177	124.4
500.00	.229	122.5	7.464	4.7	.078	– 83.1	.206	105.6
600.00	.422	45.4	6.673	– 45.2	.068	– 114.4	.181	63.5
700.00	.706	– 24.1	4.415	– 95.6	.041	– 146.7	.081	– 35.8
800.00	.834	– 67.9	2.289	– 132.0	.019	– 159.1	.172	– 143.5
900.00	.886	– 95.7	1.252	– 155.8	.011	– 149.0	.292	– 178.7
1000.00	.907	– 112.7	.741	– 170.8	.007	– 131.4	.386	161.9

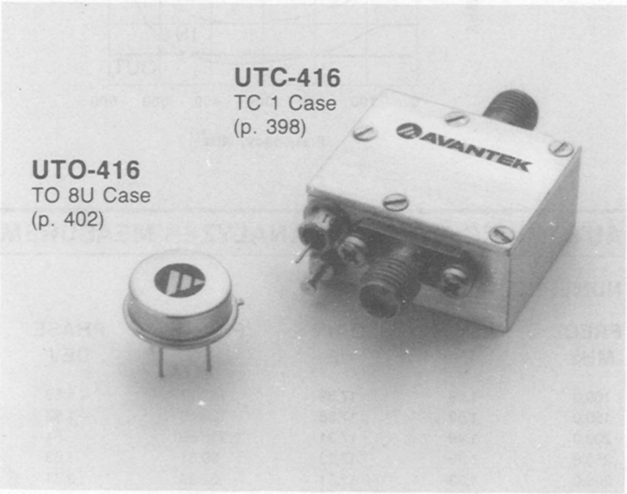
416 Series

Thin Film Cascadable Amplifier
5-400 MHz

AVANTEK

FEATURES

- **Medium Gain: 14.5 dB**
- **Medium Power Output: +12.5 dBm**



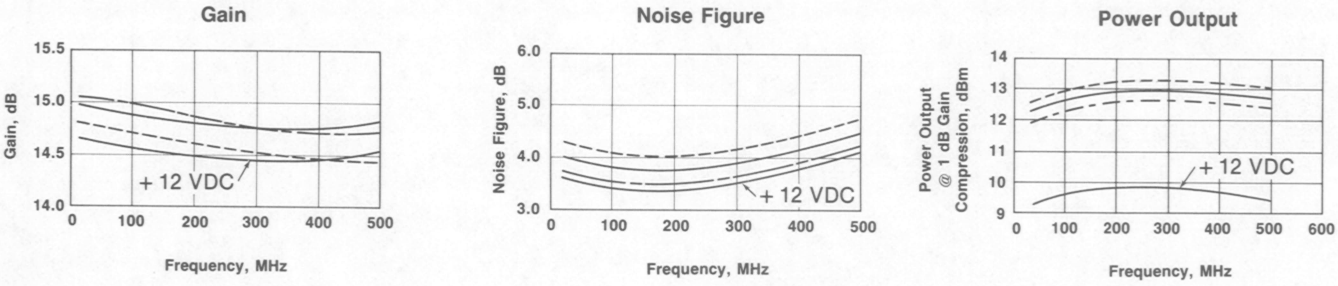
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	5-400	5-400	5-400	MHz
GP	Small Signal Gain	14.5	14.0 Min.	13.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.0	5.5 Max.	5.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+12.5	+10.0 Min.	+9.5 Min.	dBm
—	Input VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+23.0	—	—	dBm
I_D	DC Current	35	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:

+25°C	———
+85°C	— — —
−55°C	—·—·—



MAXIMUM RATINGS

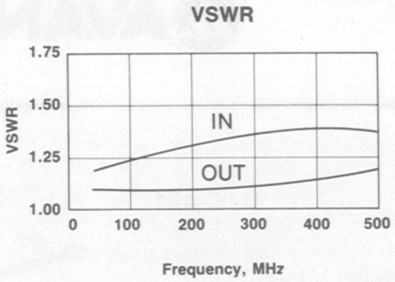
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	105°C/W
Active Transistor Power Dissipation	180 mW
Junction Temperature Above Case Temperature	19°C
MTBF	952,502 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.28	15.18	153.37	–.99	1.03	1.05	21.18
150.0	1.35	15.11	140.76	–.73	.69	1.07	21.29
200.0	1.41	14.87	128.36	–.27	.68	1.09	21.44
250.0	1.46	14.81	116.28	.50	.67	1.09	21.50
300.0	1.46	14.74	104.19	1.27	.68	1.09	21.62
350.0	1.43	14.66	91.64	1.58	.72	1.10	21.69
400.0	1.36	14.69	78.41	1.22	.76	1.10	21.81
450.0	1.23	14.81	64.34	.01	.82	1.13	21.88
500.0	1.09	14.97	48.89	–2.57	.92	1.18	21.95
550.0	1.26	15.07	31.40		1.03	1.27	21.99
600.0	1.78	14.88	11.85		1.16	1.38	22.10

LINEARIZATION RANGE: 100.0 TO 500.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
100.00	.098	–77.5	5.623	152.8	.088	–11.5	.024	63.3
200.00	.155	–110.0	5.449	130.3	.085	–24.3	.043	39.2
300.00	.173	–130.4	5.403	105.1	.084	–37.0	.048	10.5
400.00	.140	–152.4	5.405	78.9	.079	–49.4	.045	–37.6
500.00	.023	135.4	5.523	50.3	.077	–63.5	.068	–105.6
600.00	.270	–15.7	5.396	13.3	.076	–78.4	.144	–152.8
700.00	.648	–58.7	4.247	–29.8	.068	–97.6	.232	166.7
800.00	.837	–92.4	2.517	–62.9	.054	–116.4	.284	138.9
900.00	.906	–114.6	1.467	–84.7	.042	–130.8	.314	121.7
1000.00	.919	–127.5	.915	–98.1	.032	–138.8	.338	109.5

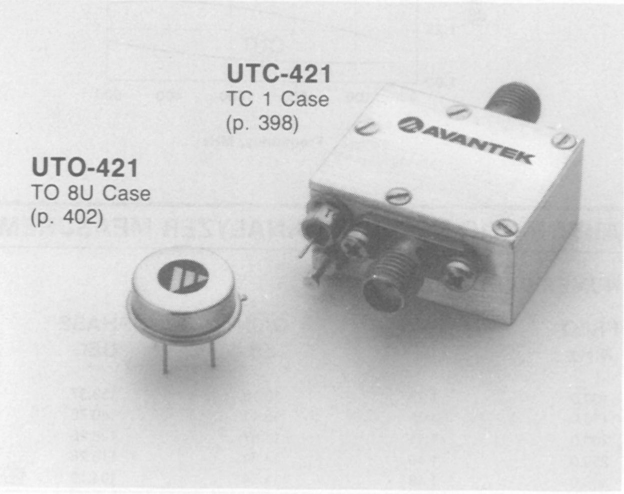
421 Series

Thin Film Cascadable Amplifier 5-400 MHz

AVANTEK

FEATURES

- **High Gain: 29.5 dB**



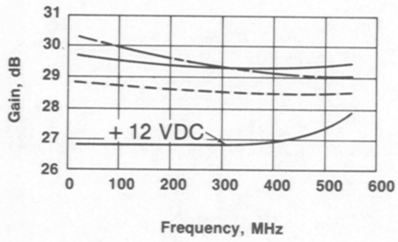
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	 T_C = −55°- +85°C	Unit
BW	Frequency Range	5-400	5-400	5-400	MHz
GP	Small Signal Gain	29.5	27.0 Min.	27.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.5	5.5 Max.	5.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+6.0	+6.0 Min.	+5.5 Min.	dBm
—	Input VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+18.0	—	—	dBm
I_D	DC Current	38	—	—	mA

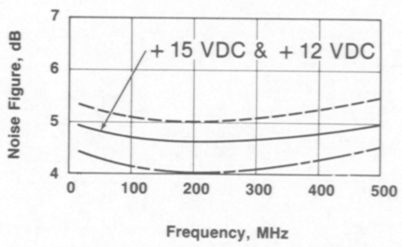
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

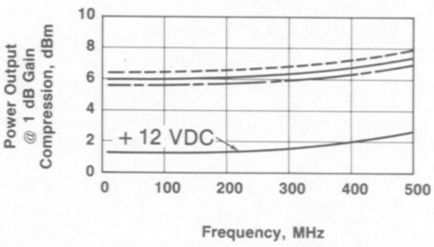
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

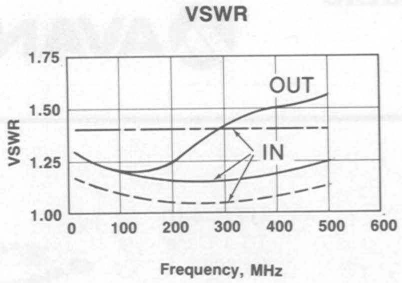
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	155/155°C/W
Active Transistor Power Dissipation	16/92 mW
Junction Temperature Above Case Temperature	2.5/14°C
MTBF	1,236,047 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.18	29.70	– 40.33	– 2.71	– 1.00	—	1.21	40.97
150.0	1.19	29.54	– 60.48	– 1.41	– .30	1.14	1.20	44.03
200.0	1.17	29.46	– 81.53	– 1.00	– .48	1.15	1.23	40.56
250.0	1.18	29.51	– 102.04	– .06	– .14	1.10	1.26	42.06
300.0	1.17	29.43	– 121.05	2.37	1.70	1.11	1.29	43.10
350.0	1.16	29.37	– 141.86	3.02	1.75	1.17	1.31	45.12
400.0	1.14	29.31	– 163.32	3.00	1.14	1.22	1.30	41.91
450.0	1.13	29.36	174.20	1.98	– .47	1.25	1.32	41.00
500.0	1.14	29.55	151.64	.88	– 2.17	1.27	1.40	39.90
550.0	1.20	29.55	128.62	– .67	—	1.37	1.52	38.51
600.0	1.40	29.46	102.45	– 5.39	—	1.53	1.80	40.82
650.0	1.85	29.09	73.62	—	—	1.67	2.29	44.57
700.0	2.62	28.35	42.43	—	—	1.68	3.14	40.06
LINEARIZATION RANGE:				100.0 TO 600.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 RATIO	21 ANGLE	12 RATIO	12 ANGLE	22 RATIO	22 ANGLE
100.00	.150	154.7	28.590	– 42.4	.005	3.8	.186	.4
200.00	.135	131.6	28.251	– 81.3	.006	– 6.3	.176	– 1.3
300.00	.123	105.4	28.358	– 119.2	.007	– 15.7	.155	– 2.0
400.00	.106	85.5	28.368	– 160.4	.007	– 20.6	.115	2.1
500.00	.106	86.8	29.566	156.1	.008	– 34.7	.062	40.2
600.00	.219	91.1	29.812	108.2	.009	– 53.4	.164	100.8
700.00	.506	57.2	27.417	49.0	.009	– 89.9	.423	84.8
800.00	.772	14.6	18.164	– 9.4	.006	– 131.8	.628	55.0
900.00	.886	– 21.7	9.986	– 57.7	.003	– 157.5	.681	30.6
1000.00	.910	– 47.2	5.417	– 93.3	.001	161.1	.633	14.5

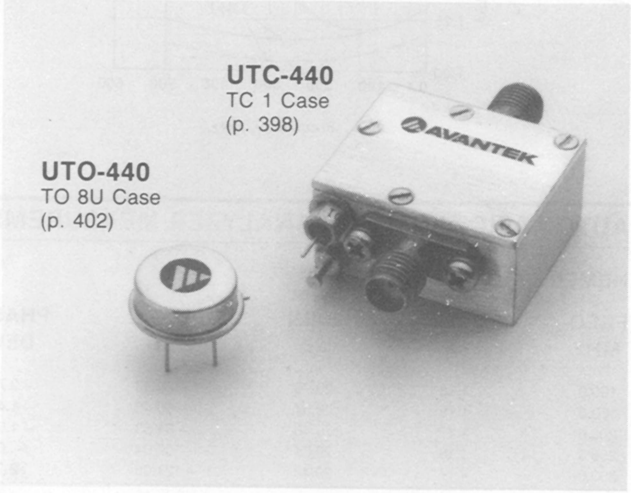
440 Series

Thin Film Cascadable Amplifier 10-400 MHz

AVANTEK

FEATURES

- **Low Current Drain: 15 mA**
- **13 dB Gain**



UTC-440
TC 1 Case
(p. 398)

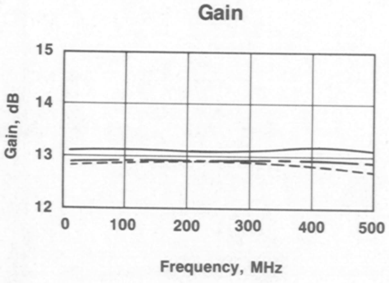
UTO-440
TO 8U Case
(p. 402)

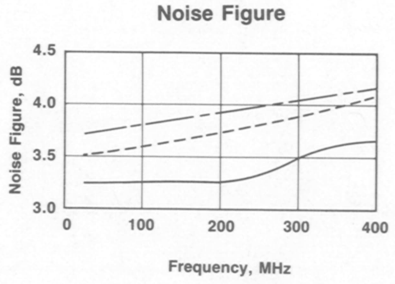
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

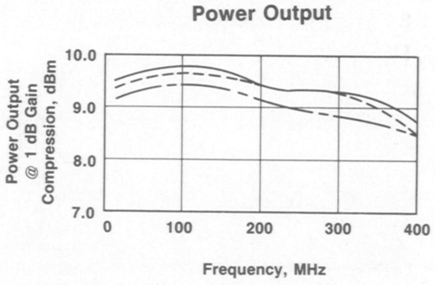
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	T_C = -55°- +85°C	Unit
BW	Frequency Range	10-500	10-400	10-400	MHz
GP	Small Signal Gain	13.0	12.5 Min.	12.0 Min.	dB
—	Gain Flatness	±0.1	±0.7 Max.	±0.7 Max.	dB
NF	Noise Figure	3.6	4.5 Max.	5.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+9.0	+8.0 Min.	+7.5 Min.	dBm
—	Input VSWR	1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.6:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+23.0	—	—	dBm
—	Two Tone 2nd Order Intercept Point	+26.0	—	—	dBm
—	One Tone 2nd Harmonic Intercept Point	+35.0	—	—	dBm
I_D	DC Current	15	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

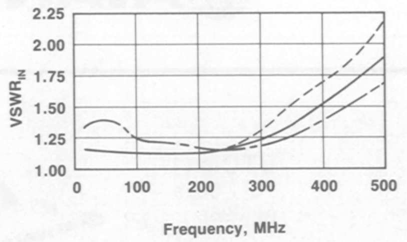
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

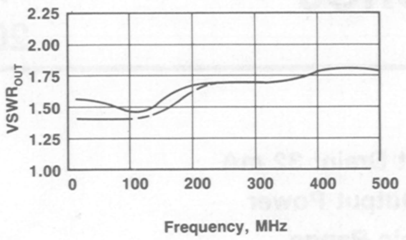
THERMAL CHARACTERISTICS*

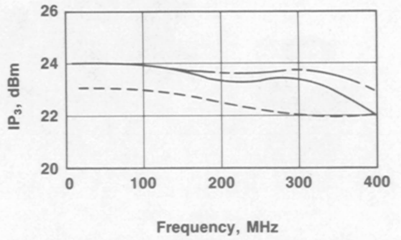
θ_{JC}	105°C/W
Active Transistor Power Dissipation	114 mW
Junction Temperature Above Case Temperature	12°C
MTBF	837,234 Hrs.

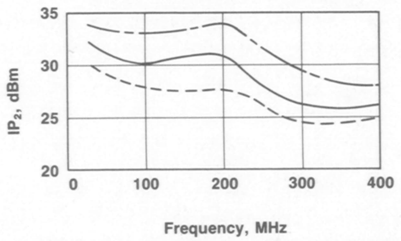
*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams


Input VSWR


Output VSWR


Third-Order Intercept Point


Second-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.21	13.14	160.14	– .17	00	1.49	19.31
200.0	1.11	13.13	138.96	– .03	.58	1.53	19.54
300.0	1.14	13.08	118.26	.59	.60	1.59	19.66
400.0	1.35	13.13	95.98	– .37	.62	1.64	19.91
500.0	1.66	13.12	73.48		.66	1.70	20.04
600.0	2.05	12.60	48.81		.73	1.81	20.05
700.0	2.49	11.68	20.72		.76	2.08	20.29
800.0	2.84	10.36	– 6.18		.74	2.62	20.56
900.0	3.02	8.40	– 32.43		.66	3.35	21.17
1000.0	3.25	5.91	– 53.76		.56	4.14	22.03
1100.0	3.60	3.33	– 72.84		.49	5.05	22.89
1200.0	4.05	1.03	– 89.06		.39	5.51	23.51
1300.0	4.56	– 1.34	– 101.23		.31	5.78	24.29
1400.0	4.96	– 3.70	– 111.45		.32	6.11	24.87
1500.0	5.40	– 5.58	– 124.08		.29	6.58	25.19
1600.0	5.76	– 6.90	– 132.54		.22	6.69	25.44
1700.0	6.24	– 7.77	– 140.12		.25	7.47	25.82
1800.0	6.94	– 7.67	– 150.63		.35	8.70	26.99
1900.0	7.94	– 7.85	– 165.11		.48	10.13	29.19
2000.0	9.34	– 7.86	175.15		.00	11.26	31.06

LINEARIZATION RANGE: 100.0 TO 400.0
REF PLANES: .00 .00 .00

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 dB	21 ANGLE	12 dB	12 ANGLE	22 RATIO	22 ANGLE
100.00	.088	175.6	13.153	159.8	–19.308	– 11.1	.197	177.8
200.00	.045	– 165.0	13.086	138.8	–19.540	– 19.2	.208	171.3
300.00	.064	– 86.8	13.112	118.0	–19.665	– 29.5	.225	159.9
400.00	.151	– 79.1	13.139	95.6	–19.913	– 39.3	.241	141.3
500.00	.251	– 87.5	13.125	72.7	–20.044	– 49.3	.255	113.6
600.00	.346	– 97.0	12.629	47.7	– 20.054	– 59.1	.284	75.4
700.00	.421	– 108.8	11.693	19.2	– 20.286	– 69.6	.343	30.8
800.00	.472	– 117.9	10.339	– 8.0	– 20.562	– 82.3	.445	– 9.5
900.00	.499	– 124.8	8.307	– 34.6	– 21.173	– 95.0	.542	– 42.3
1000.00	.528	– 129.4	5.772	– 55.4	– 22.033	– 105.6	.618	– 66.7
1100.00	.559	– 133.0	3.066	– 74.2	– 22.887	– 116.2	.666	– 85.8
1200.00	.598	– 135.9	.794	– 90.1	– 23.510	– 125.6	.714	– 100.0
1300.00	.636	– 139.2	– 1.631	– 102.1	– 24.290	– 135.1	.725	– 111.5
1400.00	.663	– 142.2	– 4.087	– 112.0	– 24.874	– 145.2	.732	– 122.1
1500.00	.682	– 145.9	– 5.941	– 123.6	– 25.193	– 156.4	.736	– 131.2
1600.00	.703	– 150.0	– 7.293	– 131.7	– 25.436	– 167.9	.748	– 137.8
1700.00	.725	– 153.2	– 8.049	– 139.5	– 25.824	176.9	.767	– 142.5
1800.00	.752	– 155.4	– 7.678	– 148.5	– 26.991	162.1	.803	– 147.3
1900.00	.782	– 157.6	– 7.587	– 164.5	– 29.190	151.1	.848	– 153.7
2000.00	.816	– 161.3	– 7.650	173.9	– 31.057	151.5	.854	– 160.3

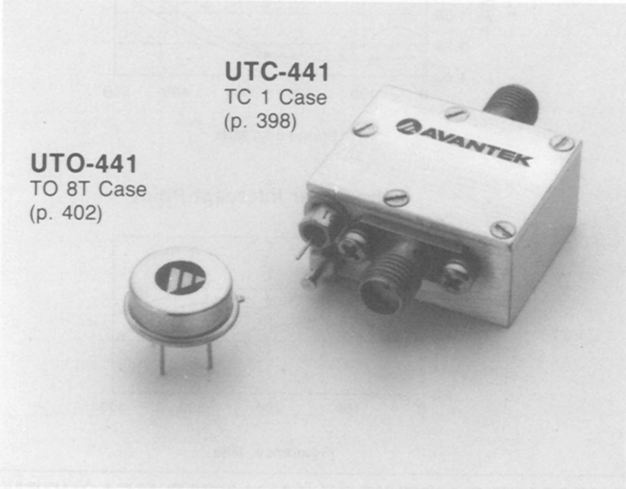
441 Series

Thin Film Cascadable Amplifier 20-400 MHz

AVANTEK

FEATURES

- **Low Current Drain: 32 mA**
- **+16 dBm Output Power**
- **High Dynamic Range**



ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

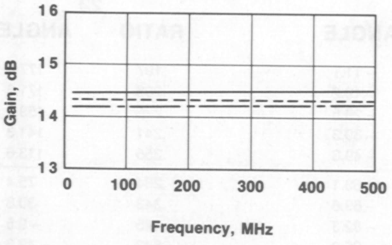
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = -55°- +85°C	
BW	Frequency Range	20-500	20-400	20-400	MHz
GP	Small Signal Gain	14.4	13.5 Min.	13.0 Min.	dB
—	Gain Flatness	±0.1	±0.7 Max.	±0.7 Max.	dB
NF	Noise Figure	3.7	4.5 Max.	5.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+16.0	+15.0 Min.	+15.0 Min.	dBm
—	Input VSWR	1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.6:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+32.0	—	—	dBm
—	Two Tone 2nd Order Intercept Point	+44.0	—	—	dBm
—	One Tone 2nd Harmonic Intercept Point	+53.0	—	—	dBm
I_D	DC Current	32	—	—	mA

NOTE 1: A portion of any DC voltage applied to the RF input pin will appear at the RF output pin (i.e., a resistive DC path exists between pins.) There is no input or output blocking capacitor.

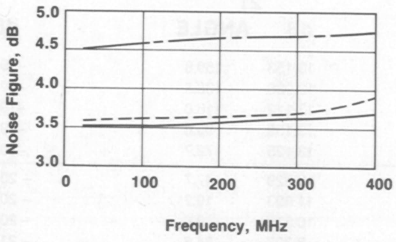
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
-55°C —·—·—

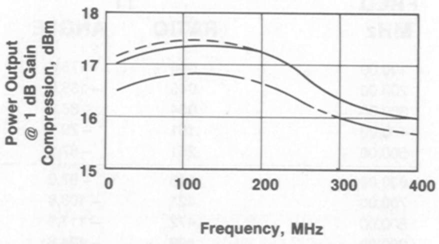
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	-55°C to +125°C
Storage Temperature	-62°C to +150°C
"R" Series Burn-In Temperature	+125°C

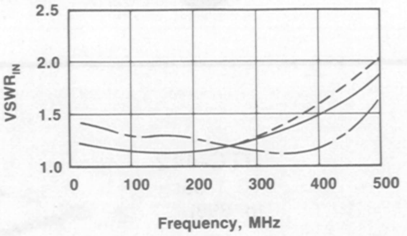
THERMAL CHARACTERISTICS*

θ_{JC}	105°C/W
Active Transistor Power Dissipation	275 mW
Junction Temperature Above Case Temperature	29°C
MTBF	832,066 Hrs.

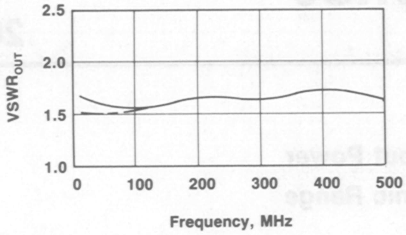
*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams

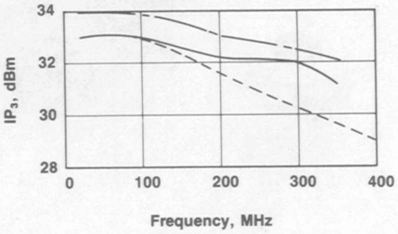
Input VSWR



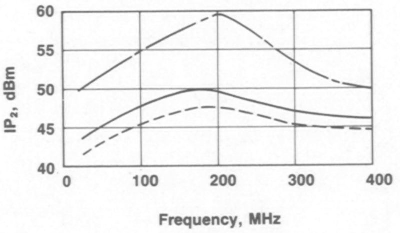
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.29	14.47	159.85	– .20	.00	1.58	20.57
200.0	1.16	14.48	137.59	– .04	.61	1.60	20.54
300.0	1.10	14.47	115.94	.71	.63	1.62	20.67
400.0	1.31	14.55	92.37	– .46	.66	1.61	20.80
500.0	1.65	14.55	68.22		.71	1.58	20.75
600.0	2.06	14.02	40.97		.81	1.62	20.80
700.0	2.42	12.99	9.62		.86	2.05	21.14
800.0	2.57	11.24	– 20.83		.81	2.97	21.80
900.0	2.62	8.62	– 48.65		.69	4.23	22.93
1000.0	2.85	5.58	– 70.55		.56	5.82	24.28
1100.0	3.22	2.48	– 88.84		.48	7.37	25.47
1200.0	3.73	– .38	– 105.01		.39	8.14	26.46
1300.0	4.35	– 3.09	– 116.83		.30	8.94	27.45
1400.0	4.91	– 5.58	– 126.82		.31	10.05	28.28
1500.0	5.33	– 7.73	– 138.87		.29	11.49	28.62
1600.0	5.80	– 9.13	– 147.96		.26	11.93	29.21
1700.0	6.49	– 10.02	– 157.56		.33	14.13	29.82
1800.0	7.49	– 10.22	– 171.66		.43	15.96	31.03
1900.0	8.86	– 10.72	171.53		.52	17.35	32.54
2000.0	10.69	– 11.10	151.12		.00	19.05	32.88

LINEARIZATION RANGE: 100.0 TO 400.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.125	175.3	14.498	159.7	– 20.566	– 9.0	.226	175.3
200.00	.067	173.3	14.473	137.4	– 20.541	– 20.6	.231	170.6
300.00	.044	– 98.1	14.512	115.4	– 20.672	– 29.1	.235	159.9
400.00	.140	– 79.8	14.572	92.0	– 20.798	– 40.4	.230	141.4
500.00	.251	– 90.2	14.575	67.6	– 20.749	– 51.7	.215	108.7
600.00	.349	– 102.5	14.047	40.0	– 20.802	– 63.7	.233	56.4
700.00	.408	– 116.5	12.979	8.1	– 21.145	– 77.8	.336	– .4
800.00	.430	– 125.3	11.186	– 22.4	– 21.804	– 93.2	.493	– 41.5
900.00	.441	– 129.2	8.527	– 50.5	– 22.933	– 107.6	.625	– 71.5
1000.00	.476	– 130.9	5.423	– 71.7	– 24.275	– 118.8	.711	– 92.8
1100.00	.522	– 133.1	2.179	– 89.8	– 25.472	– 128.5	.765	– 108.7
1200.00	.575	– 135.9	– .609	– 105.1	– 26.457	– 137.7	.806	– 120.2
1300.00	.624	– 139.6	– 3.362	– 116.9	– 27.448	– 147.4	.815	– 130.0
1400.00	.660	– 143.2	– 6.063	– 125.9	– 28.277	– 156.6	.827	– 139.1
1500.00	.683	– 147.3	– 8.075	– 136.5	– 28.621	– 167.8	.841	– 146.6
1600.00	.708	– 151.6	– 9.429	– 144.2	– 29.211	– 178.9	.858	– 152.7
1700.00	.733	– 154.9	– 9.908	– 153.8	– 29.815	166.1	.874	– 157.7
1800.00	.773	– 157.2	– 9.395	– 168.5	– 31.033	155.2	.898	– 162.9
1900.00	.816	– 160.5	– 9.778	170.3	– 32.541	151.5	.911	– 168.1
2000.00	.848	– 165.4	– 10.473	146.1	– 32.885	150.5	.907	– 172.4

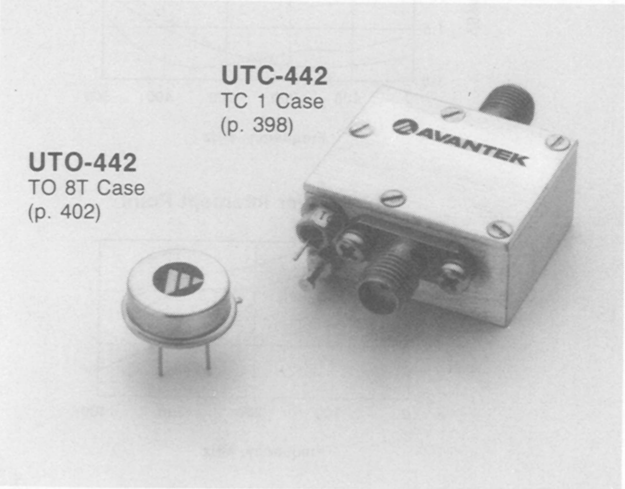
442 Series

Thin Film Cascadable Amplifier 20-400 MHz

AVANTEK

FEATURES

- **+21.0 Output Power**
- **High Dynamic Range**


UTC-442
TC 1 Case
(p. 398)

UTO-442
TO 8T Case
(p. 402)

ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications[1] $T_C = 0°$-$50°C$	Guaranteed Specifications[1] $T_C = -55°$- $+85°C$	Unit
BW	Frequency Range	20-500	20-400	20-400	MHz
GP	Small Signal Gain	14.0	13.0 Min.	12.5 Min.	dB
—	Gain Flatness	±0.1	±0.7 Max.	±0.7 Max.	dB
NF	Noise Figure	4.7	5.5 Max.	6.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+21.5	+20.0 Min.	+19.0 Min.	dBm
—	Input VSWR	1.4:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.6:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+33.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+47.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+54.0	—	—	dBm
I_D	DC Current	62	—	—	mA

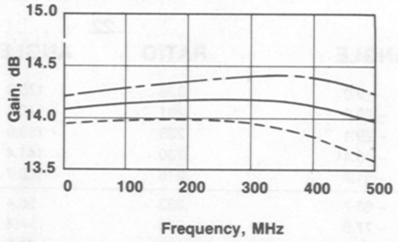
NOTE: 1: A portion of any DC voltage applied to the RF input pin will appear at the RF output pin (i.e., a resistive DC path exists between pins). There is no input or output blocking capacitor.

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

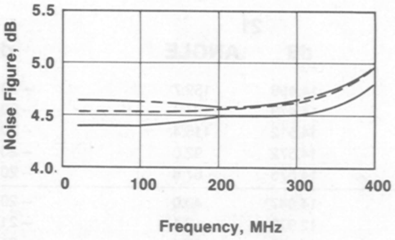
KEY:

+25°C	———
+85°C	— — —
−55°C	—·—·—

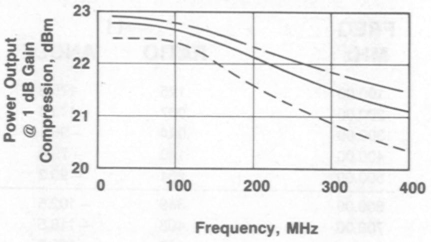
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

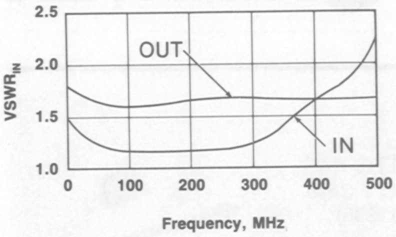
DC Voltage .... +17 Volts
Continuous RF Input Power .... +15 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +100°C

THERMAL CHARACTERISTICS*

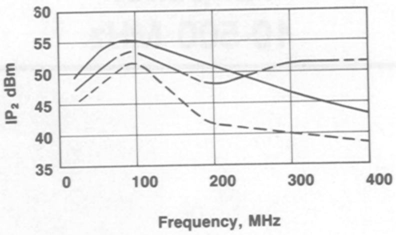
θ_{JC} .... 85°C/W
Active Transistor Power Dissipation .... 560 mW
Junction Temperature Above Case Temperature .... 48°C
MTBF .... 740,499 Hrs.

*For further information, see High Reliability section.

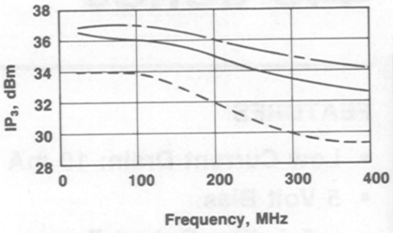
WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams



VSWR



Second-Order Intercept Point



Third-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.27	14.28	159.58	−.10	.00	1.56	20.19
200.0	1.16	14.24	135.61	−.18	.65	1.63	20.04
300.0	1.20	14.21	112.60	.69	.67	1.71	19.93
400.0	1.42	14.28	87.62	−.39	.71	1.70	19.54
500.0	1.79	14.16	61.81		.75	1.66	18.97
600.0	2.18	13.35	33.33		.81	1.84	18.74
700.0	2.38	12.00	3.35		.79	2.48	19.14
800.0	2.25	10.16	−23.81		.71	3.47	19.82
900.0	2.03	7.96	−47.93		.61	4.50	20.78
1000.0	1.92	5.67	−67.95		.53	5.61	21.60
1100.0	1.91	3.48	−86.21		.51	6.50	22.37
1200.0	2.05	1.57	−104.37		.48	6.85	22.92
1300.0	2.37	−.24	−120.63		.44	7.29	23.45
1400.0	2.83	−1.95	−136.35		.48	7.97	23.82
1500.0	3.37	−3.61	−155.27		.50	9.08	24.33
1600.0	3.90	−4.97	−172.42		.45	9.81	25.05
1700.0	4.35	−6.42	172.50		.43	12.30	25.83
1800.0	4.47	−7.58	156.80		.39	14.53	26.73
1900.0	4.26	−8.68	144.23		.37	16.73	27.88
2000.0	3.97	−9.10	129.81		.00	19.75	29.13

LINEARIZATION RANGE: 100.0 TO 400.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 dB	21 ANGLE	12 dB	12 ANGLE	22 RATIO	22 ANGLE
100.00	.114	−174.4	14.267	159.5	−20.192	−6.4	.222	174.1
200.00	.078	−161.1	14.200	135.7	−20.036	−15.1	.236	168.9
300.00	.088	−110.1	14.200	112.5	−19.930	−24.0	.259	153.6
400.00	.173	−97.4	14.267	87.7	−19.535	−33.5	.255	122.8
500.00	.278	−107.8	14.108	62.4	−18.969	−45.4	.248	77.1
600.00	.375	−123.5	13.328	34.0	−18.737	−60.1	.301	17.3
700.00	.423	−137.5	12.030	4.4	−19.137	−76.4	.424	−30.4
800.00	.399	−148.3	10.245	−22.9	−19.818	−91.6	.548	−64.2
900.00	.347	−154.1	8.040	−47.3	−20.776	−104.6	.635	−87.7
1000.00	.316	−152.4	5.730	−67.1	−21.600	−115.9	.699	−104.6
1100.00	.320	−145.6	3.545	−85.6	−22.371	−126.0	.734	−116.7
1200.00	.358	−138.1	1.649	−104.1	−22.915	−137.3	.746	−127.0
1300.00	.410	−134.2	−.234	−119.9	−23.449	−149.5	.759	−135.9
1400.00	.480	−135.5	−1.931	−135.2	−23.823	−162.5	.780	−143.1
1500.00	.547	−140.3	−3.591	−154.4	−24.334	−177.1	.799	−148.7
1600.00	.601	−146.6	−4.917	−171.5	−25.052	168.4	.819	−154.1
1700.00	.631	−154.6	−6.355	173.5	−25.826	153.1	.852	−158.7
1800.00	.640	−161.5	−7.511	157.7	−26.731	140.7	.869	−163.1
1900.00	.631	−166.7	−8.626	144.9	−27.885	128.4	.887	−168.0
2000.00	.604	−171.7	−9.017	130.7	−29.130	117.6	.905	−172.5

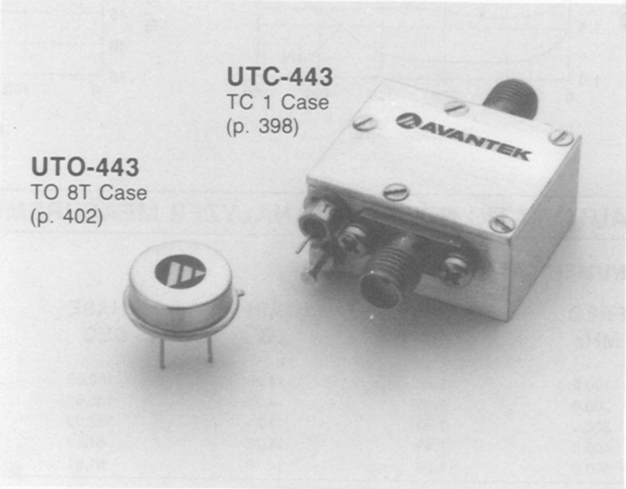
443 Series

Thin Film Cascadable Amplifier 10-500 MHz

AVANTEK

FEATURES

- **Low Current Drain: 10 mA**
- **5 Volt Bias**
- **+5.5 dBm Output Power**



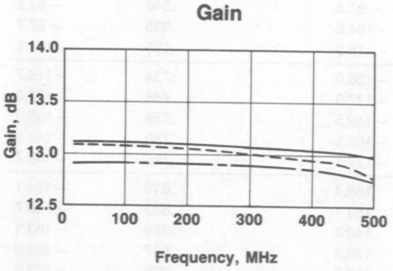
ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +5 VDC nominal unless otherwise noted)

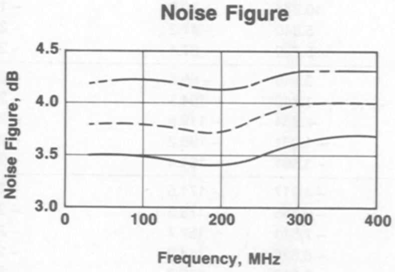
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications[1] T_C = 0°-50°C	T_C = -55°- +85°C	Unit
BW	Frequency Range	10-500	10-400	10-400	MHz
GP	Small Signal Gain	13.2	12.5 Min.	12.0 Min.	dB
—	Gain Flatness	±0.1	±0.7 Max.	±0.7 Max.	dB
NF	Noise Figure	3.6	4.5 Max.	5.0 Max.	dB
$P_{1\ dB}$	Power Output @ + 1 dB Compression	+5.5	+4.5 Min.	+4.0 Min.	dBm
—	Input VSWR	1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.6:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+19.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+25.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+32.0	—	—	dBm
I_D	DC Current	10	—	—	mA

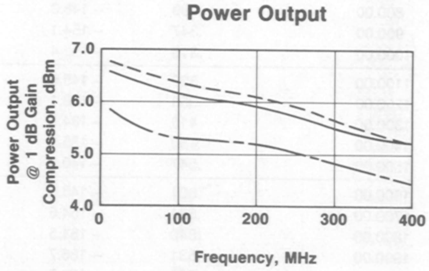
NOTE 1: A portion of any DC voltage applied to the RF input pin will appear at the RF output pin (i.e., a resistive DC path exists between pins). There is no input or output blocking capacitor.

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +5 VDC unless otherwise noted)

KEY: +25°C ———
+85°C — — — —
-55°C —·—·—







MAXIMUM RATINGS

DC Voltage	+10 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	-55°C to +125°C
Storage Temperature	-62°C to +150°C
"R" Series Burn-In Temperature	+125°C

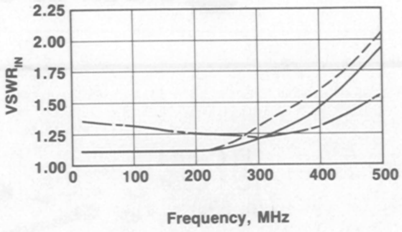
THERMAL CHARACTERISTICS*

θ_{JC}	105°C/W
Active Transistor Power Dissipation	28 mW
Junction Temperature Above Case Temperature	3°C
MTBF	783,266 Hrs.

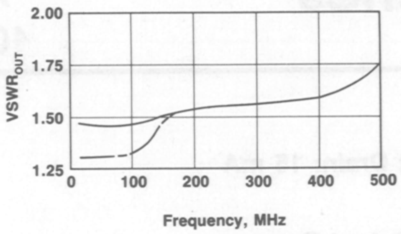
*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams

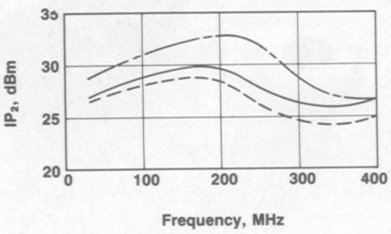
Input VSWR



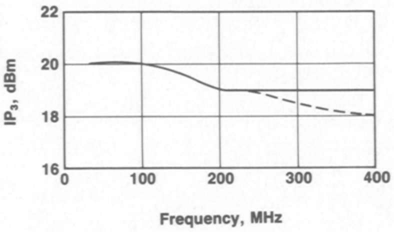
Output VSWR



Second-Order Intercept Point



Third-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 5.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.26	13.33	159.56	– .23	.00	1.50	19.51
200.0	1.18	13.30	138.13	.03	.59	1.52	19.55
300.0	1.20	13.27	117.02	.63	.61	1.58	19.66
400.0	1.38	13.28	94.25	– .43	.64	1.62	19.76
500.0	1.68	13.20	71.24		.67	1.67	19.78
600.0	2.03	12.61	46.30		.73	1.79	19.67
700.0	2.41	11.61	18.33		.76	2.09	19.87
800.0	2.64	10.23	– 8.25		.72	2.65	20.21
900.0	2.71	8.25	– 33.73		.64	3.38	20.87
1000.0	2.86	5.86	– 54.40		.55	4.12	21.76
1100.0	3.11	3.43	– 73.22		.49	4.97	22.62
1200.0	3.45	1.26	– 89.61		.41	5.37	23.24
1300.0	3.87	– .94	– 102.39		.34	5.60	23.90
1400.0	4.28	– 3.11	– 113.78		.36	5.87	24.48
1500.0	4.75	– 4.86	– 128.37		.36	6.33	24.82
1600.0	5.28	– 6.14	– 140.03		.32	6.46	25.45
1700.0	6.04	– 7.32	– 151.61		.35	7.06	25.87
1800.0	6.96	– 8.15	– 164.99		.38	7.66	26.80
1900.0	7.78	– 9.43	– 178.69		.40	8.34	27.79
2000.0	8.75	– 10.45	166.01		.00	9.61	28.49

LINEARIZATION RANGE: 100.0 TO 400.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 5 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 dB	21 ANGLE	12 dB	12 ANGLE	22 RATIO	22 ANGLE
100.00	.113	– 178.4	13.376	159.1	– 19.514	– 9.0	.202	176.7
200.00	.074	– 159.9	13.283	137.8	– 19.547	– 18.0	.208	168.9
300.00	.083	– 113.2	13.294	116.6	– 19.662	– 27.0	.220	155.8
400.00	.156	– 98.1	13.298	93.7	– 19.761	– 37.3	.233	134.1
500.00	.251	– 102.4	13.217	70.5	– 19.781	– 46.8	.244	104.2
600.00	.340	– 110.3	12.641	45.2	– 19.667	– 57.6	.279	63.8
700.00	.407	– 120.9	11.615	16.7	– 19.873	– 68.6	.347	19.7
800.00	.441	– 129.0	10.216	– 10.0	– 20.212	– 82.3	.450	– 17.6
900.00	.457	– 134.9	8.200	– 35.9	– 20.867	– 95.3	.543	– 47.8
1000.00	.478	– 137.8	5.766	– 56.3	– 21.759	– 106.3	.615	– 69.9
1100.00	.506	– 139.2	3.166	– 74.8	– 22.616	– 115.8	.662	– 87.6
1200.00	.542	– 140.7	1.043	– 90.7	– 23.245	– 125.9	.705	– 100.6
1300.00	.584	– 142.7	– 1.207	– 103.4	– 23.899	– 134.8	.716	– 111.3
1400.00	.618	– 145.5	– 3.466	– 114.4	– 24.481	– 145.7	.723	– 121.3
1500.00	.646	– 148.6	– 5.154	– 127.9	– 24.823	– 157.5	.729	– 129.7
1600.00	.681	– 152.1	– 6.435	– 138.9	– 25.447	– 168.5	.744	– 136.3
1700.00	.717	– 155.9	– 7.396	– 151.3	– 25.868	178.7	.762	– 141.0
1800.00	.756	– 159.2	– 7.860	– 164.6	– 26.804	168.6	.786	– 146.0
1900.00	.785	– 162.9	– 9.016	179.1	– 27.794	160.5	.812	– 150.9
2000.00	.806	– 167.3	– 10.304	161.3	– 28.487	153.3	.824	– 155.0

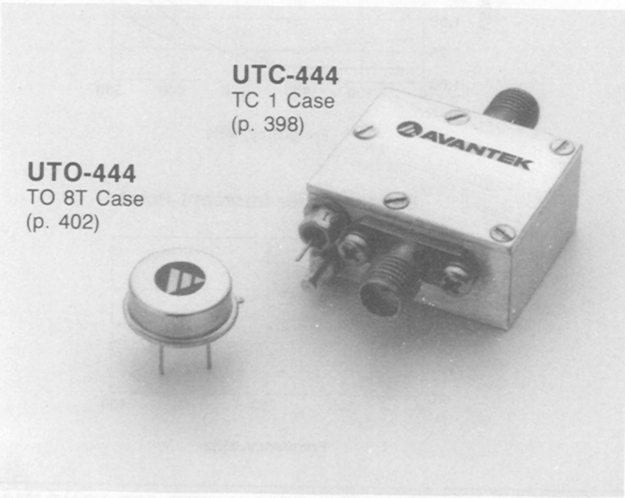
444 Series

Thin Film Cascadable Amplifier
10-400 MHz

AVANTEK

FEATURES

- **Low Current Drain: 15 mA**
- **5 Volt Bias**
- **+8.7 dBm Output Power**


UTC-444
TC 1 Case
(p. 398)

UTO-444
TO 8T Case
(p. 402)

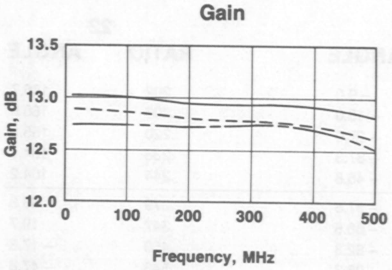
ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +5 VDC nominal unless otherwise noted)

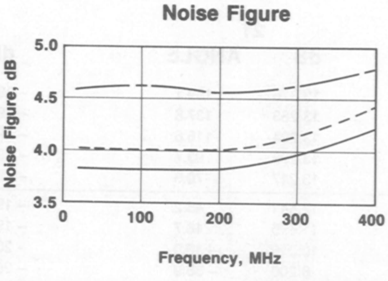
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications[1] T_C = 0°-50°C	Guaranteed Specifications[1] T_C = -55°- +85°C	Unit
BW	Frequency Range	10-500	10-400	10-400	MHz
GP	Small Signal Gain	13.0	12.5 Min.	12.0 Min.	dB
—	Gain Flatness	±0.1	±0.7 Max.	±0.7 Max.	dB
NF	Noise Figure	4.0	5.0 Max.	5.5 Max.	dB
$P_{1\ dB}$	Power Output @ + 1 dB Compression	+8.7	+8.0 Min.	+7.5 Min.	dBm
—	Input VSWR	1.4:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.6:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+22.0	—	—	dBm
—	Two Tone 2nd Order Intercept Point	+35.0	—	—	dBm
—	One Tone 2nd Harmonic Intercept Point	+41.0	—	—	dBm
I_D	DC Current	15	—	—	mA

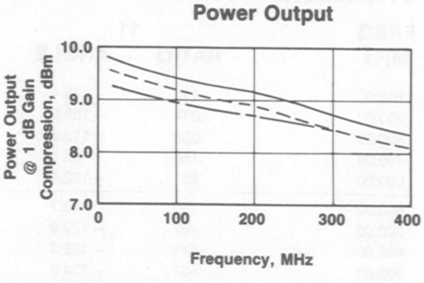
NOTE 1: A portion of any DC voltage applied to the RF input pin will appear at the RF output pin (i.e., a resistive DC path exists between pins). There is no input or output blocking capacitor.

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +5 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
-55°C —·—·—


Gain


Noise Figure


Power Output

MAXIMUM RATINGS

DC Voltage .... +10 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... -55°C to +125°C
Storage Temperature .... -62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

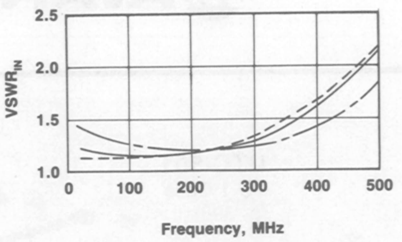
THERMAL CHARACTERISTICS*

θ_{JC} .... 105°C/W
Active Transistor Power Dissipation .... 45 mW
Junction Temperature Above Case Temperature .... 5°C
MTBF .... 773,999 Hrs.

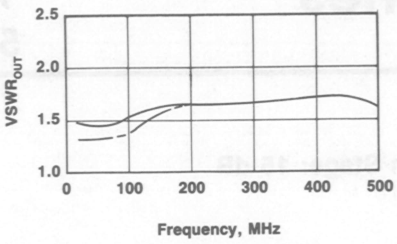
*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams

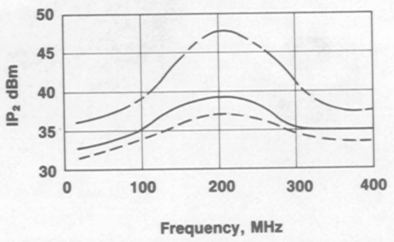
Input VSWR



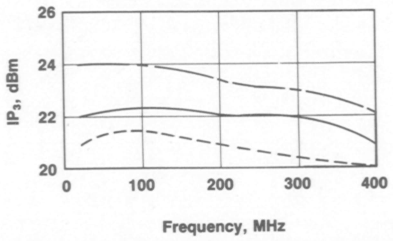
Output VSWR



Second-Order Intercept Point



Third-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 5.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.23	13.21	158.58	−.13	.00	1.52	19.61
200.0	1.12	13.15	136.10	−.06	.62	1.58	19.68
300.0	1.18	13.07	114.15	.54	.63	1.63	19.70
400.0	1.43	13.11	90.72	−.33	.66	1.62	19.74
500.0	1.82	13.08	66.71		.70	1.55	19.64
600.0	2.24	12.53	40.08		.79	1.52	19.57
700.0	2.62	11.55	9.86		.83	1.87	19.82
800.0	2.69	9.97	−19.52		.79	2.70	20.55
900.0	2.62	7.63	−46.67		.68	3.86	21.68
1000.0	2.72	4.89	−68.33		.56	5.30	23.00
1100.0	2.98	2.12	−86.69		.49	6.78	24.16
1200.0	3.37	−.42	−103.32		.41	7.60	25.07
1300.0	3.84	−2.78	−115.92		.33	8.44	25.95
1400.0	4.31	−4.90	−127.01		.34	9.73	26.75
1500.0	4.75	−6.75	−140.57		.35	11.01	27.17
1600.0	5.27	−8.04	−152.20		.33	11.64	27.88
1700.0	5.98	−9.04	−164.18		.37	13.42	28.60
1800.0	6.92	−9.76	−178.99		.40	14.82	29.79
1900.0	7.88	−10.70	166.69		.43	16.32	30.17
2000.0	8.68	−11.39	150.37		.00	18.63	30.27

LINEARIZATION RANGE: 100.0 TO 400.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 5 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.097	176.5	13.245	158.2	−19.608	−10.6	.210	−178.7
200.00	.051	−160.6	13.121	135.8	−19.683	−20.6	.226	177.2
300.00	.083	−92.2	13.093	113.7	−19.702	−30.0	.237	166.1
400.00	.183	−88.6	13.094	90.1	−19.735	−41.7	.232	146.1
500.00	.293	−98.5	13.050	65.9	−19.637	−52.8	.206	112.5
600.00	.383	−110.7	12.514	39.0	−19.570	−65.4	.202	55.7
700.00	.439	−124.2	11.506	8.3	−19.819	−80.1	.299	−7.1
800.00	.446	−133.3	9.892	−21.1	−20.547	−96.4	.459	−48.5
900.00	.437	−137.2	7.498	−48.5	−21.677	−111.4	.591	−77.9
1000.00	.452	−137.4	4.719	−69.1	−23.003	−123.1	.685	−98.7
1100.00	.486	−137.3	1.823	−87.6	−24.159	−132.2	.748	−114.4
1200.00	.533	−138.4	−.632	−103.5	−25.070	−142.2	.789	−126.1
1300.00	.581	−140.2	−3.045	−115.8	−25.951	−151.8	.803	−135.9
1400.00	.619	−143.4	−5.335	−125.9	−26.754	−161.1	.818	−145.2
1500.00	.645	−146.9	−7.067	−138.2	−27.170	−173.3	.837	−152.7
1600.00	.674	−150.7	−8.197	−148.6	−27.877	176.4	.855	−158.6
1700.00	.708	−153.9	−8.787	−160.8	−28.595	163.8	.871	−163.9
1800.00	.751	−156.9	−8.753	−176.8	−29.788	157.4	.894	−169.3
1900.00	.786	−160.7	−9.644	164.0	−30.169	152.5	.898	−174.3
2000.00	.806	−165.7	−10.704	143.5	−30.272	144.5	.899	−178.2

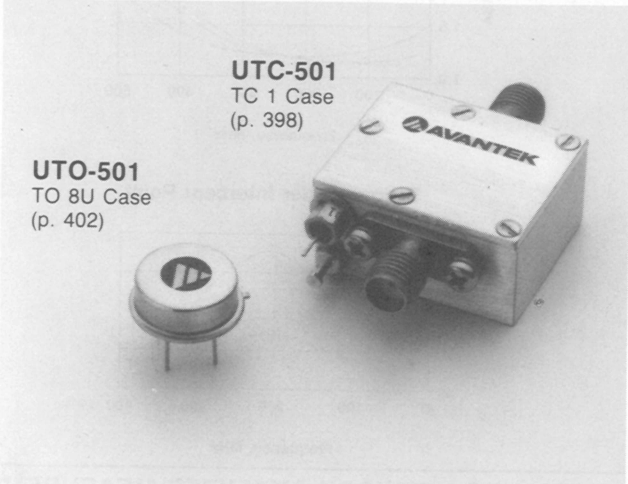
501 Series

Thin Film Cascadable Amplifier 5-500 MHz

AVANTEK

FEATURES

- **Medium Gain Stage: 15 dB**



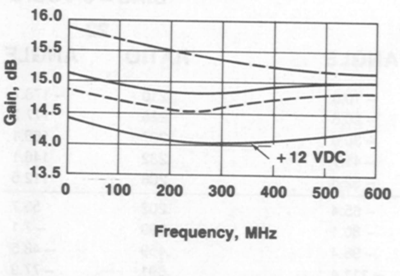
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	15.0	14.0 Min.	13.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.0	4.0 Max.	4.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+1.0	−2.0 Min.	−3.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+11.0	—	—	dBm
I_D	DC Current	10	—	—	mA

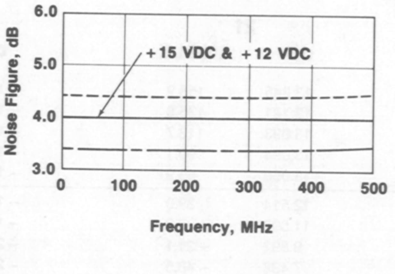
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:	
+25°C	———
+85°C	— — —
−55°C	—·—·—

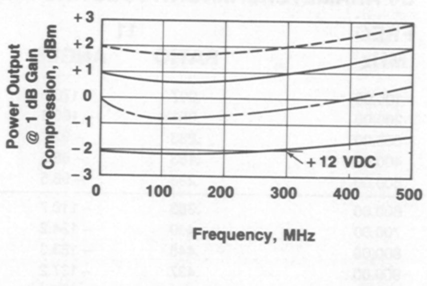
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

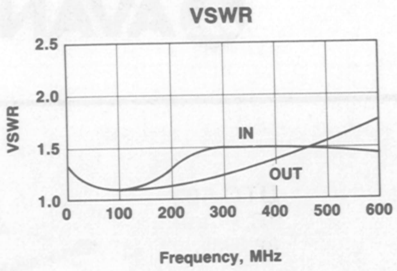
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	155°C/W
Active Transistor Power Dissipation	67 mW
Junction Temperature Above Case Temperature	10.3°C
MTBF	1,090,779 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.07	15.06	158.71	– 1.86	– .69	—	1.06	19.84
150.0	1.14	14.96	149.37	– .62	.22	.53	1.10	20.16
200.0	1.17	14.89	139.51	.08	.62	.58	1.10	19.96
250.0	1.19	14.90	128.38	– .47	– .24	.58	1.12	20.16
300.0	1.22	14.92	118.62	.35	.25	.55	1.14	20.03
350.0	1.24	14.83	108.62	.92	.51	.59	1.17	19.93
400.0	1.25	14.84	97.36	.24	– .47	.59	1.20	20.14
450.0	1.24	14.97	87.46	.92	– .10	.56	1.22	19.87
500.0	1.22	14.94	77.21	1.25	– .09	.57	1.26	19.80
550.0	1.19	14.99	66.82	1.45	—	.60	1.31	19.92
600.0	1.12	15.05	55.74	.95	—	.61	1.34	19.54
650.0	1.08	15.00	44.96	.75	—	.64	1.36	19.81
700.0	1.07	15.15	32.62	– 1.00	—	.63	1.35	19.92
750.0	1.15	15.20	22.29	– .74	—	.62	1.42	19.61
800.0	1.28	15.13	10.21	– 2.23	—	.70	1.43	19.65
850.0	1.45	15.07	– 3.08	—	—	.72	1.41	19.68
900.0	1.70	14.99	– 15.78	—	—	.73	1.42	20.09
950.0	2.02	14.68	– 29.33	—	—	.76	1.44	19.92
1000.0	2.41	14.49	– 43.11	—	—	.75	1.43	20.42
1050.0	2.91	14.03	– 56.17	—	—	.69	1.46	20.99
1100.0	3.61	13.42	– 68.11	—	—	.70	1.53	21.38
1150.0	4.65	12.97	– 81.29	—	—	.73	1.59	22.47
1200.0	5.63	12.04	– 94.41	—	—	.72	1.66	23.61
LINEARIZATION RANGE:				100.0 TO 800.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ MHz	11		21		12		22	
	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
100.00	.031	74.2	5.663	156.9	.102	– 5.0	.027	– 178.7
200.00	.059	67.8	5.586	138.7	.102	– 11.9	.038	169.8
300.00	.078	58.2	5.601	118.0	.103	– 19.3	.060	154.9
400.00	.083	49.8	5.550	96.9	.101	– 26.2	.083	139.9
500.00	.070	45.5	5.596	77.1	.104	– 35.0	.113	123.4
600.00	.042	60.7	5.653	55.8	.104	– 43.4	.137	105.8
700.00	.055	132.8	5.748	33.3	.106	– 52.3	.163	85.0
800.00	.144	142.6	5.638	11.0	.105	– 63.4	.176	61.7
900.00	.271	132.2	5.589	– 15.2	.102	– 76.8	.178	31.2
1000.00	.419	117.4	5.303	– 40.5	.098	– 90.4	.164	– 8.6

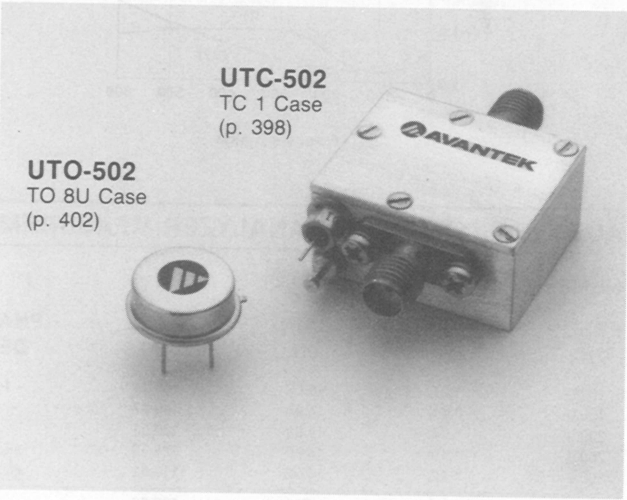
502 Series

Thin Film Cascadable Amplifier 5-500 MHz

AVANTEK

FEATURES

- **Medium Gain Stage: 14.5 dB**
- **Medium Power Output: +8.0 dBm**

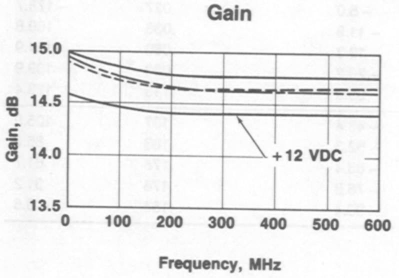


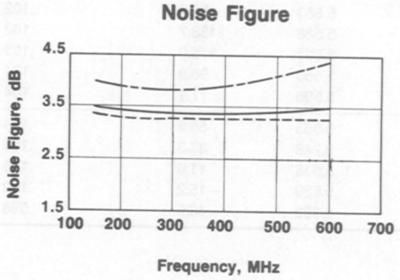
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

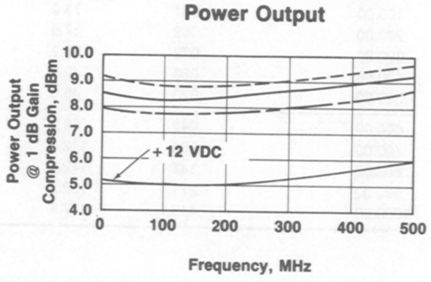
Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		$T_C = 25°C$	$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	14.5	14.0 Min.	13.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	3.5	4.0 Max.	4.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+8.0	+7.0 Min.	+7.0 Min.	dBm
—	Input VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Outut VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+21.0		—	dBm
I_D	DC Current	23		—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

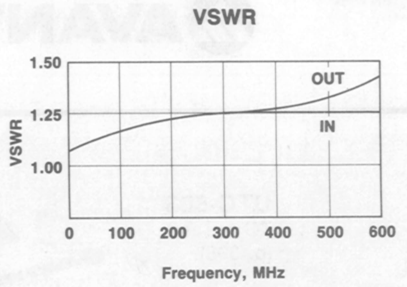
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	155°C/W
Active Transistor Power Dissipation	120 mW
Junction Temperature Above Case Temperature	18.6°C
MTBF	1,163,841 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.06	14.88	159.07	– 1.71	– .72	—	1.06	20.91
150.0	1.11	14.78	149.98	– .35	.35	.53	1.10	20.51
200.0	1.13	14.74	140.11	.21	.65	.59	1.12	21.06
250.0	1.14	14.74	128.87	– .58	– .40	.58	1.15	20.82
300.0	1.17	14.81	119.31	.30	.21	.54	1.16	20.69
350.0	1.18	14.67	109.49	.90	.55	.59	1.21	21.10
400.0	1.19	14.68	98.24	.10	– .51	.58	1.25	20.98
450.0	1.19	14.79	88.51	.81	– .07	.55	1.25	20.81
500.0	1.19	14.76	78.37	1.11	– .04	.57	1.29	20.89
550.0	1.19	14.81	68.04	1.23	—	.59	1.35	20.52
600.0	1.18	14.83	57.17	.79	—	.60	1.38	20.58
650.0	1.23	14.74	46.35	.41	—	.63	1.40	21.01
700.0	1.29	14.85	34.54	– .94	—	.61	1.41	20.86
750.0	1.41	14.89	24.51	– .54	—	.60	1.45	20.78
800.0	1.56	14.77	12.88	– 1.73	—	.67	1.45	21.09
850.0	1.77	14.71	.23	—	—	.68	1.43	21.20
900.0	2.02	14.62	– 11.75	—	—	.69	1.39	21.26
950.0	2.41	14.32	– 24.58	—	—	.72	1.38	21.47
1000.0	2.81	14.15	– 37.67	—	—	.70	1.33	22.11
1050.0	3.34	13.77	– 49.83	—	—	.64	1.29	21.94
1100.0	4.20	13.26	– 60.89	—	—	.66	1.27	22.13
1150.0	5.33	12.88	– 73.51	—	—	.70	1.27	23.24
1200.0	6.49	12.10	– 86.00	—	—	.68	1.29	23.94
LINEARIZATION RANGE:				100.0 TO 800.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 RATIO	21 ANGLE	12 RATIO	12 ANGLE	22 RATIO	22 ANGLE
100.00	.030	73.6	5.407	157.7	.094	– 5.4	.025	– 153.0
200.00	.056	69.3	5.338	139.9	.093	– 12.2	.040	– 164.0
300.00	.073	63.1	5.365	119.8	.094	– 19.8	.062	178.5
400.00	.079	59.3	5.306	99.4	.092	– 27.0	.086	161.3
500.00	.074	62.4	5.363	80.1	.094	– 35.8	.116	143.5
600.00	.066	84.8	5.417	59.7	.092	– 43.4	.139	126.3
700.00	.093	115.5	5.512	38.1	.094	– 51.7	.164	106.3
800.00	.173	125.4	5.454	16.9	.091	– 61.9	.177	86.0
900.00	.293	120.1	5.473	– 8.3	.088	– 74.6	.179	60.4
1000.00	.438	108.3	5.293	– 32.7	.084	– 86.9	.154	31.5

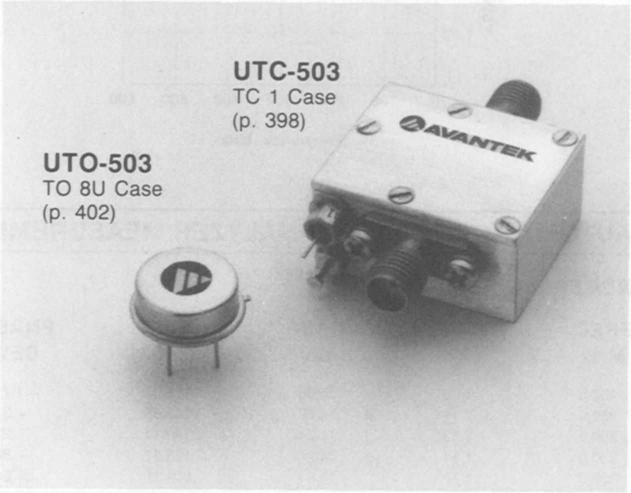
503 Series

Thin Film Cascadable Amplifier
5-500 MHz

AVANTEK

FEATURES

- **Medium Output Power: +15.0 dBm**
- **24 Volt Bias**

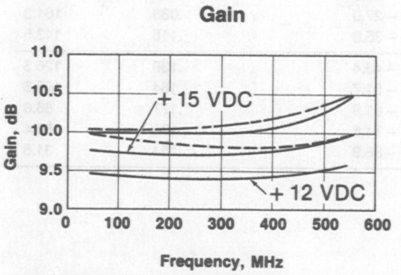


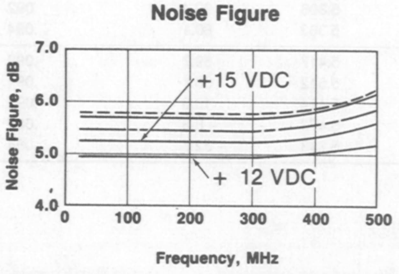
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +24 VDC nominal unless otherwise noted)

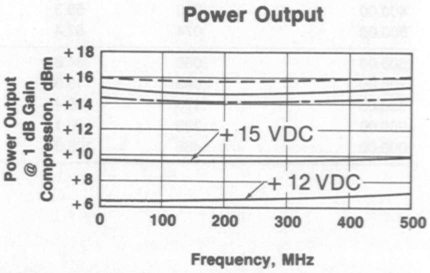
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	Guaranteed Specifications $T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	10.0	9.0 Min.	8.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	5.5	7.0 Max.	7.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+15.0	+13.0 Min.	+13.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+33.0	—	—	dBm
—	Two Tone 2nd Order Intercept Point	+42.0	—	—	dBm
—	One Tone 2nd Harmonic Intercept Point	+48.0	—	—	dBm
I_D	DC Current	50	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +24 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
−55°C —·—·—·—







MAXIMUM RATINGS

DC Voltage	+26 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +115°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+115°C

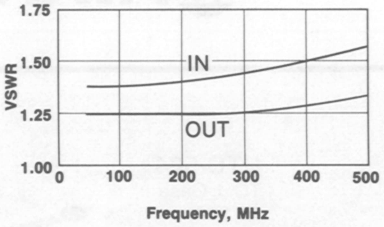
THERMAL CHARACTERISTICS*

θ_{JC}	105°C/W
Active Transistor Power Dissipation	360 mW
Junction Temperature Above Case Temperature	37.8°C
MTBF	983,779 Hrs.

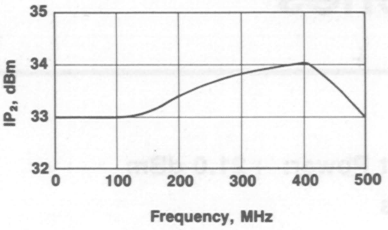
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

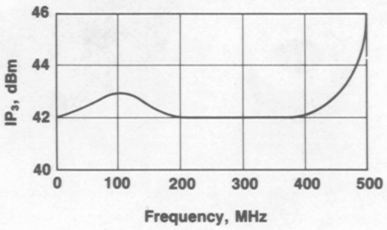
VSWR



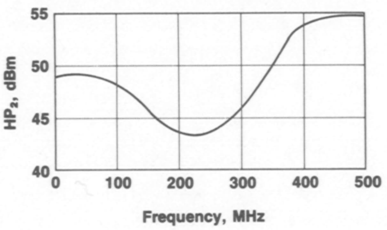
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS BIAS = 24.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.16	10.90	163.43	–.11	.08	—	1.09	16.96
150.0	1.18	10.79	155.51	.13	.26	.45	1.10	16.96
200.0	1.23	10.82	147.23	.01	.09	.47	1.11	16.94
250.0	1.28	10.85	138.76	–.30	–.28	.46	1.12	16.96
300.0	1.33	10.98	130.74	–.14	–.19	.45	1.14	16.98
350.0	1.39	11.11	122.54	–.20	–.30	.45	1.15	17.01
400.0	1.48	11.24	114.64	.06	–.10	.44	1.16	17.02
450.0	1.57	11.39	106.81	.39	.16	.44	1.17	17.06
500.0	1.68	11.60	98.81	.56	.27	.45	1.18	17.10
550.0	1.83	11.82	90.45	.35	—	.46	1.19	17.19
600.0	1.98	12.06	82.09	.14	—	.49	1.20	17.32
650.0	2.18	12.36	72.90	–.89	—	.53	1.19	17.47
700.0	2.39	12.72	63.04	—	—	.57	1.19	17.67
750.0	2.66	13.13	52.30	—	—	.64	1.19	17.92
800.0	3.07	13.57	40.09	—	—	.73	1.18	18.25
LINEARIZATION RANGE:				100.0 TO 650.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES BIAS = 24.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
100.00	.061	174.0	3.039	162.5	.156	–7.6	.149	162.1
200.00	.046	170.6	3.027	148.9	.154	–15.7	.153	144.9
300.00	.027	176.0	3.063	133.2	.154	–24.6	.164	128.4
400.00	.018	–116.4	3.055	117.0	.149	–33.3	.170	114.3
500.00	.045	–87.7	3.152	101.6	.150	–44.1	.177	103.3
600.00	.079	–97.1	3.236	85.6	.145	–53.6	.176	94.2
700.00	.105	–113.5	3.383	67.7	.139	–62.5	.172	85.7
800.00	.113	–143.2	3.567	49.5	.128	–72.0	.160	81.4
900.00	.098	154.3	3.822	26.2	.118	–80.7	.139	80.3
1000.00	.189	63.2	3.926	–1.3	.112	–85.5	.118	95.8

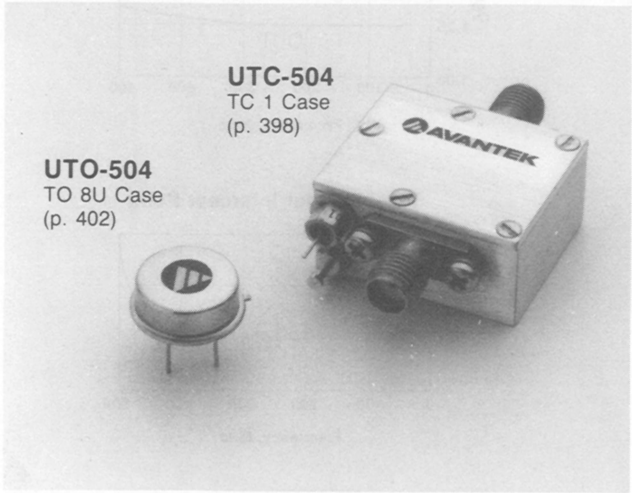
504 Series

Thin Film Cascadable Amplifier 5-500 MHz

AVANTEK

FEATURES

- **High Output Power: +21.0 dBm**
- **24 Volt Bias**



UTC-504
TC 1 Case
(p. 398)

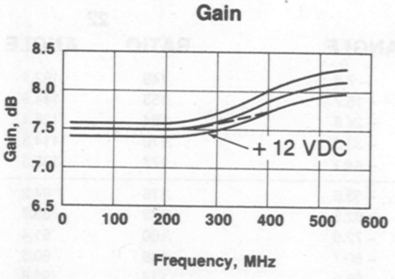
UTO-504
TO 8U Case
(p. 402)

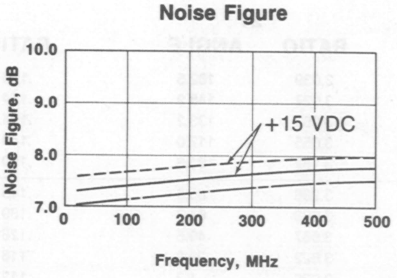
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +24 VDC nominal unless otherwise noted)

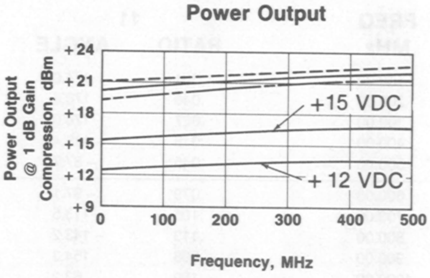
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	7.0	6.0 Min.	6.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	7.5	11.0 Max.	11.0 Max.	dB
$P_{1 dB}$	Power Output @ + 1 dB Compression	+21.0	+17.0 Min.	+17.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Outut VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+34.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+44.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+50.0	—	—	dBm
I_D	DC Current	100	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +24 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

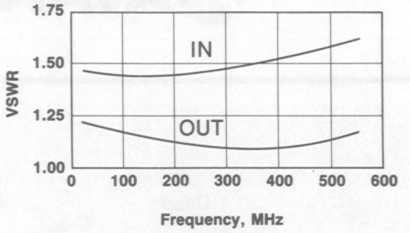
DC Voltage	+26 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +115°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+115°C

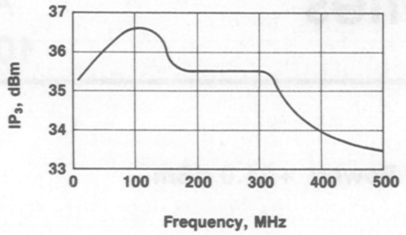
THERMAL CHARACTERISTICS*

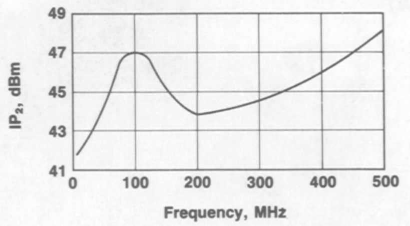
θ_{JC}	53°C/W
Active Transistor Power Dissipation	760 mW
Junction Temperature Above Case Temperature	40°C
MTBF	1,344,046 Hrs.

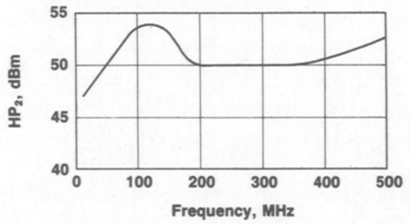
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams


VSWR


Third-Order Intercept Point


Second-Order Intercept Point


Second Harmonic Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +85°C ambient)

NUMERICAL READINGS

BIAS = 24.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.25	7.06	162.04	−2.91	−.93	—	1.35	16.35
150.0	1.30	7.26	151.15	−2.74	−1.39	.55	1.34	16.54
200.0	1.35	7.38	142.12	−.71	.00	.51	1.31	16.70
250.0	1.40	7.45	132.92	1.14	1.21	.53	1.28	16.87
300.0	1.46	7.52	122.88	2.15	1.59	.57	1.24	16.95
350.0	1.52	7.62	112.34	2.66	1.47	.61	1.19	17.00
400.0	1.58	7.70	100.98	2.35	.52	.64	1.15	16.92
450.0	1.64	7.79	89.32	1.74	−.71	.64	1.11	16.59
500.0	1.72	7.83	77.84	1.32	−1.77	.65	1.11	16.16
550.0	1.81	7.72	65.76	.29	—	.67	1.16	15.71
600.0	1.92	7.64	53.70	−.70	—	.67	1.25	15.31
650.0	2.06	7.39	41.72	−1.64	—	.68	1.36	14.95
700.0	2.29	6.99	29.32	−2.97	—	.71	1.49	14.65
750.0	2.54	6.54	16.27	—	—	.72	1.64	14.38
800.0	2.90	5.97	3.42	—	—	.70	1.81	14.22
LINEARIZATION RANGE:				100.0 TO 700.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 24.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.105	−16.9	7.113	165.0	−16.290	−6.8	.130	163.9
150.00	.094	−27.5	7.171	157.3	−16.493	−9.3	.129	157.7
200.00	.080	−43.1	7.260	148.8	−16.519	−12.4	.123	148.9
250.00	.065	−69.3	7.407	140.0	−16.644	−14.1	.116	143.0
300.00	.062	−112.5	7.574	130.7	−16.742	−16.1	.110	139.4
350.00	.087	−151.9	7.753	120.8	−16.752	−17.7	.106	139.2
400.00	.134	−176.8	7.923	110.8	−16.735	−19.4	.102	142.3
450.00	.197	165.0	7.991	100.6	−16.638	−20.5	.106	148.3
500.00	.268	150.3	7.959	89.8	−16.430	−22.6	.121	153.5
550.00	.347	137.5	7.800	78.9	−16.226	−25.3	.144	155.9
600.00	.427	125.8	7.475	67.9	−15.978	−28.7	.173	155.1
650.00	.499	115.4	7.041	57.1	−15.792	−32.8	.207	151.3
700.00	.563	105.8	6.506	47.0	−15.722	−37.1	.242	146.3
750.00	.616	96.6	5.850	37.2	−15.666	−41.2	.273	141.1
800.00	.659	88.2	5.143	28.1	−15.682	−45.7	.300	135.9
850.00	.697	80.6	4.406	19.8	−15.775	−49.8	.324	130.3
900.00	.729	73.7	3.672	11.9	−15.887	−53.9	.346	125.2
950.00	.754	67.5	2.933	4.7	−16.033	−57.9	.366	120.5
1000.00	.777	61.9	2.230	−2.0	−16.152	−61.6	.381	116.0
1050.00	.795	56.6	1.538	−8.3	−16.344	−64.9	.395	111.8
1100.00	.809	51.7	.871	−14.3	−16.529	−68.1	.410	107.9
1150.00	.821	47.0	.275	−20.4	−16.750	−71.4	.422	104.2

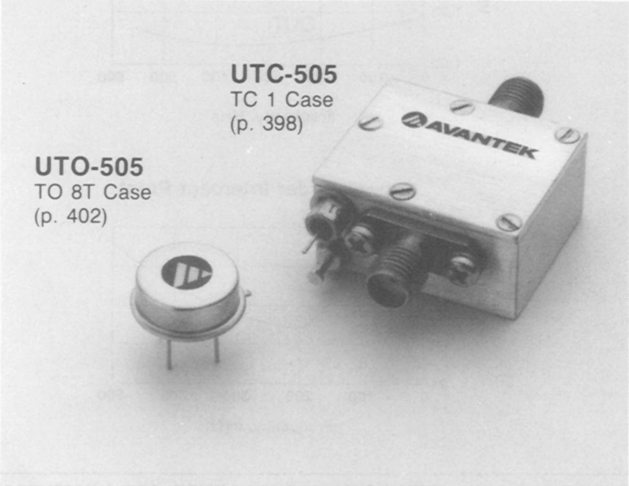
505 Series

Thin Film Cascadable Amplifier 10-500 MHz

AVANTEK

FEATURES

- **High Output Power: +21.0 dBm**

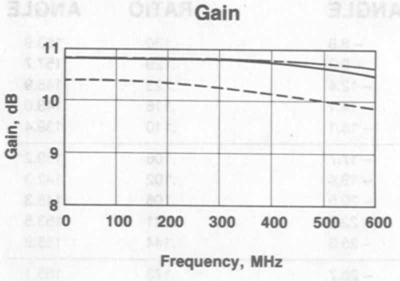


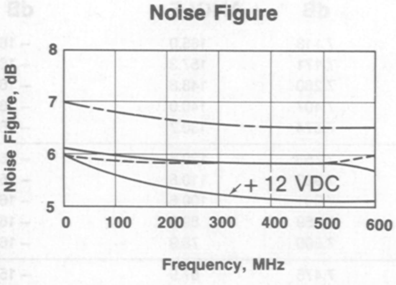
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

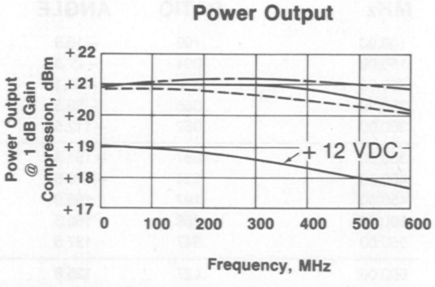
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°-50°C$	$T_C = -55°- +85°C$	Unit
BW	Frequency Range	10-500	10-500	10-500	MHz
GP	Small Signal Gain	10.5	9.0 Min.	9.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	6.0	7.0 Min.	7.5 Min.	dB
$P_{1 dB}$	Power Output @ + 1 dB Compression	+21.0	+18.0 Min.	+18.0 Min.	dBm
—	Input VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+33.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+40.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+46.0	—	—	dBm
I_D	DC Current	95	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ———
+85°C — — —
−55°C —·—·—







MAXIMUM RATINGS

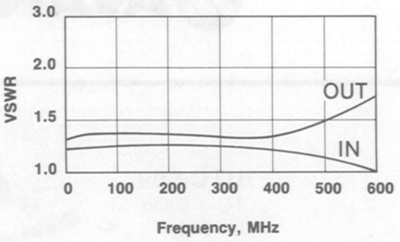
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

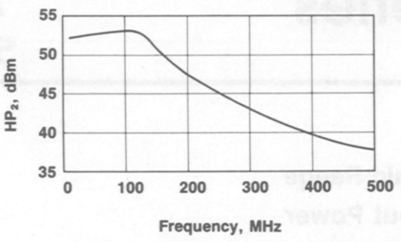
θ_{JC}	40°C/W
Active Transistor Power Dissipation	510 mW
Junction Temperature Above Case Temperature	20°C
MTBF	930,705 Hrs.

*For further information, see High Reliability section.

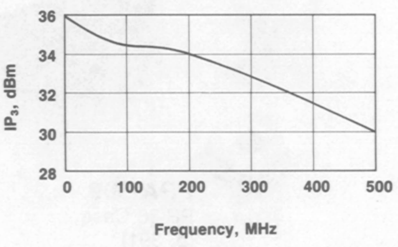
WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



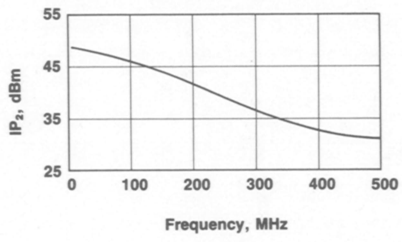
VSWR



Second Harmonic Intercept Point



Third-Order Intercept Point



Second-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	ISOL dB	VSWR OUT
100.0	1.33	11.14	160.33	.57	.00	17.56	1.24
150.0	1.32	11.07	150.09	.18	.57	17.54	1.25
200.0	1.33	11.00	139.79	– .24	.56	17.48	1.27
250.0	1.32	10.96	129.83	– .35	.55	17.43	1.28
300.0	1.32	10.95	119.84	– .46	.55	17.40	1.31
350.0	1.30	10.89	110.06	– .39	.53	17.35	1.35
400.0	1.28	10.86	100.67	.07	.53	17.23	1.39
450.0	1.24	10.81	91.06	.33	.54	17.17	1.45
500.0	1.20	10.76	81.16	.30	.55	17.13	1.52
550.0	1.15	10.72	71.31	—	.56	17.07	1.62
600.0	1.11	10.67	61.13	—	.58	17.03	1.75
650.0	1.11	10.67	50.55	—	.60	17.01	1.89
700.0	1.18	10.64	39.60	—	.61	17.01	2.06
750.0	1.30	10.67	28.71	—	.66	17.01	2.29
800.0	1.48	10.67	15.96	—	.75	17.16	2.58
850.0	1.76	10.65	1.87	—	.83	17.43	2.85
900.0	2.22	10.50	– 13.96	—	.93	17.83	3.09
950.0	3.02	10.05	– 31.74	—	1.00	18.50	3.24
1000.0	4.37	9.08	– 49.80	—	.96	19.44	3.21
1050.0	6.27	7.59	– 66.42	—	.85	20.58	3.02
1100.0	8.39	5.80	– 80.45	—	.71	21.65	2.82
1150.0	10.47	3.85	– 91.94	—	.57	22.71	2.70
1200.0	12.33	1.96	– 101.07	—	.49	23.68	2.63

LINEARIZATION RANGE: 100.0 TO 500.0

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.127	– 169.7	11.118	162.9	– 17.619	– 5.6	.110	178.7
200.00	.132	– 166.8	10.999	145.5	– 17.550	– 12.7	.116	– 175.5
300.0	.133	– 167.8	10.923	128.4	– 17.466	– 19.9	.134	– 172.3
400.0	.122	– 173.7	10.849	111.9	– 17.325	– 27.5	.163	– 171.5
500.0	.096	174.0	10.748	95.5	– 17.183	– 36.5	.207	– 173.6
600.0	.059	139.1	10.659	78.5	– 17.103	– 46.7	.266	– 179.8
700.0	.077	61.9	10.632	59.7	– 17.025	– 58.5	.347	171.4
800.0	.182	30.4	10.678	38.9	– 17.208	– 71.0	.434	159.1
900.00	.366	13.5	10.502	12.1	– 17.924	– 87.1	.505	142.4
1000.00	.620	– 7.8	9.113	– 20.5	– 19.481	– 103.5	.516	123.9

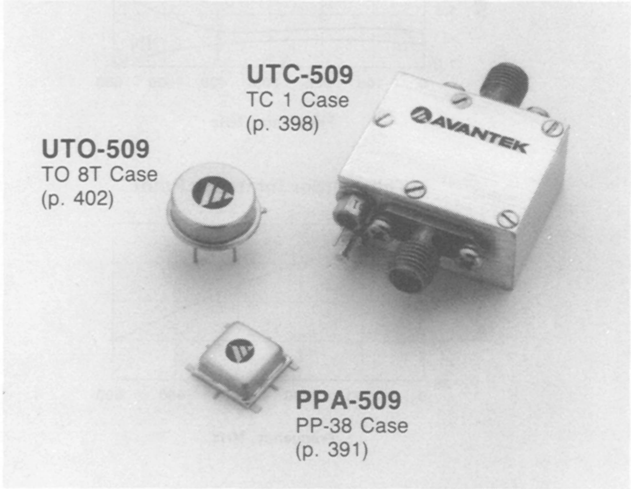
509 Series

Thin Film Cascadable Amplifier
5-500 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **+22.3 Output Power**
- **4.5 dB Noise Figure**



UTC-509
TC 1 Case
(p. 398)

UTO-509
TO 8T Case
(p. 402)

PPA-509
PP-38 Case
(p. 391)

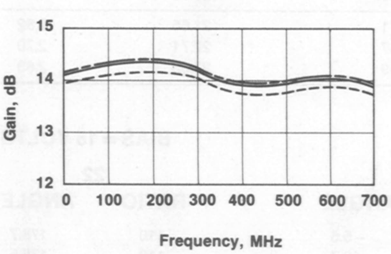
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	14.3	13.0 Min.	12.0 Min.	dB
—	Gain Flatness	±0.3	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	4.5	5.5 Max.	6.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+22.3	+20.0 Min.	+20.0 Min.	dBm
—	Input VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+35.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+50.0	—	—	dBm
I_D	DC Current	90	—	—	mA

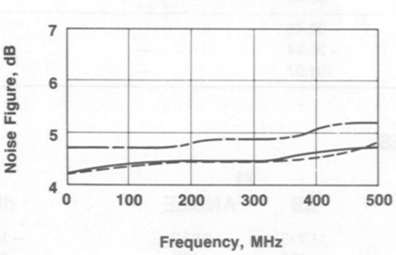
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:	
+25°C	———
+85°C	— — —
−55°C	—·—·—

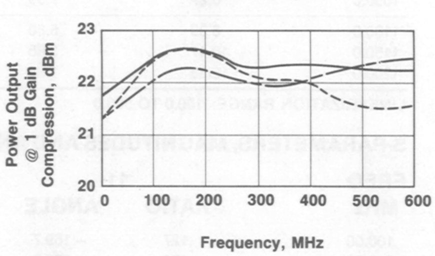
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+15 dBm
Operating Case Temperature	−55°C to +115°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+115°C

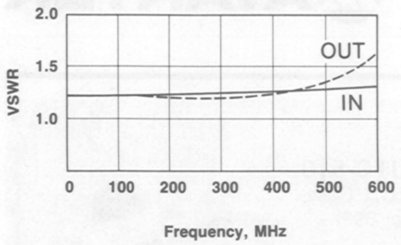
THERMAL CHARACTERISTICS*

θ_{JC}	45°C/W
Active Transistor Power Dissipation	830 mW
Junction Temperature Above Case Temperature	37°C
MTBF	562,406 Hrs.

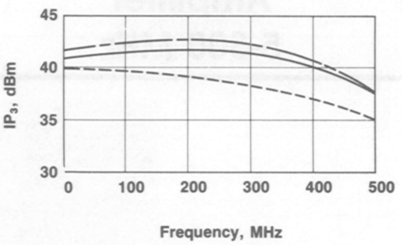
*For further information, see High Reliability section.

WEIGHT: (typical) PPA—0.5 grams; UTO—2.1 grams; UTC—21.5 grams

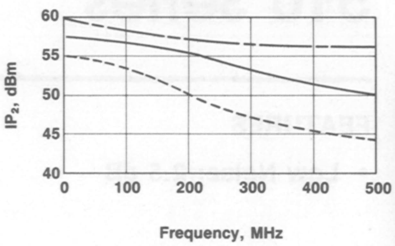
VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.11	14.69	167.83	– .21	.00	1.09	18.73
150.0	1.12	14.70	161.60	– .36	.32	1.11	18.68
200.0	1.14	14.61	156.20	.32	.32	1.14	18.59
250.0	1.16	14.54	149.99	.19	.34	1.16	18.67
300.0	1.17	14.49	143.81	.09	.34	1.20	18.64
350.0	1.19	14.38	137.89	.25	.33	1.24	18.61
400.0	1.19	14.32	131.76	.20	.35	1.29	18.61
450.0	1.20	14.24	125.23	– .24	.35	1.34	18.58
500.0	1.21	14.22	119.13	– .25	.34	1.40	18.54
550.0	1.23	14.27	112.91	—	.35	1.46	18.40
600.0	1.24	14.23	106.42	—	.36	1.53	18.34
650.0	1.29	14.21	100.01	—	.38	1.59	18.31
700.0	1.37	14.17	92.65	—	.43	1.66	18.25
750.0	1.49	14.12	84.40	—	.48	1.74	18.27
800.0	1.64	14.04	75.54	—	.52	1.80	18.32
850.0	1.86	14.12	65.84	—	.55	1.84	18.38
900.0	2.27	14.02	55.59	—	.60	1.83	18.75
950.0	2.96	13.73	44.41	—	.68	1.75	19.15
1000.0	4.04	13.12	31.03	—	.70	1.63	20.02
1050.0	5.65	12.10	19.02	—	.64	1.49	21.02
1100.0	7.83	10.69	7.85	—	.56	1.35	22.26
1150.0	10.64	8.92	– 1.24	—	.44	1.25	23.57
1200.0	12.36	7.07	– 8.08	—	.31	1.21	24.30
1250.0	12.36	5.29	– 12.57	—	.21	1.21	25.47
1300.0	12.31	3.62	– 15.74	—	.13	1.23	26.15
1350.0	13.42	2.10	– 17.32	—	.08	1.26	26.85
1400.0	13.75	.67	– 18.71	—	.08	1.30	27.78
1450.0	13.02	– .78	– 20.10	—	.04	1.33	28.30
1500.0	12.66	– 2.03	– 20.17	—	.00	1.35	28.52

LINEARIZATION RANGE: 100.0 TO 500.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.053	– 152.1	14.644	166.7	– 18.644	– 2.1	.044	– 160.3
200.00	.065	– 162.4	14.574	153.6	– 18.711	– 6.8	.064	– 133.6
300.00	.078	– 179.6	14.473	140.2	– 18.704	– 11.8	.091	– 128.1
400.00	.087	159.4	14.295	126.8	– 18.637	– 17.4	.126	– 128.4
500.00	.097	130.4	14.181	113.1	– 18.580	– 24.2	.163	– 132.0
600.00	.111	98.6	14.192	99.4	– 18.428	– 31.7	.205	– 138.9
700.00	.161	72.4	14.129	84.4	– 18.270	– 40.1	.246	– 148.6
800.00	.242	48.4	14.047	66.0	– 18.330	– 50.3	.282	– 162.5
900.00	.389	26.2	14.033	44.4	– 18.731	– 63.0	.293	179.5
1000.00	.608	– 1.0	13.111	19.0	– 19.939	– 78.4	.239	157.2
1100.00	.776	– 29.1	10.641	– 5.7	– 22.229	– 88.3	.151	143.9
1200.00	.855	– 51.6	7.060	– 22.9	– 24.374	– 88.9	.098	158.7
1300.00	.857	– 68.2	3.547	– 31.6	– 26.234	– 88.4	.104	176.0
1400.00	.867	– 79.3	.613	– 35.6	– 27.653	– 90.8	.131	173.3
1500.00	.868	– 87.1	– 2.105	– 38.2	– 28.563	– 90.7	.153	164.1
1600.00	.865	– 92.8	– 4.330	– 40.6	– 29.732	– 93.3	.179	152.4
1700.00	.875	– 97.4	– 6.341	– 41.4	– 30.476	– 94.3	.199	142.8
1800.00	.864	– 101.4	– 8.131	– 43.6	– 31.627	– 92.8	.231	133.9
1900.00	.900	– 105.7	– 9.563	– 43.8	– 32.251	– 93.6	.257	127.6
2000.00	.884	– 108.7	– 11.263	– 43.7	– 32.793	– 94.3	.284	124.2

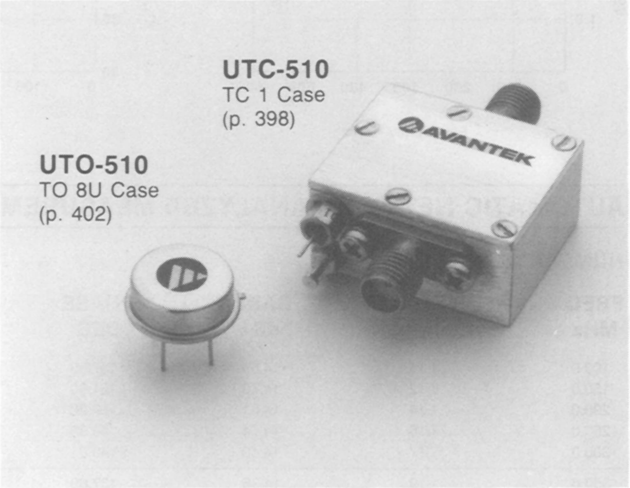
510 Series

Thin Film Cascadable Amplifier
5-500 MHz

AVANTEK

FEATURES

- **Low Noise: 2.5 dB**



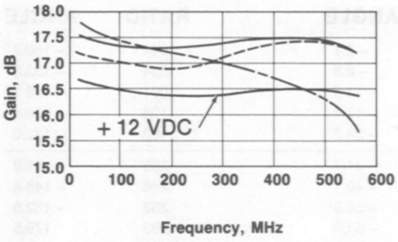
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-}+85°C$	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	17.5	15.0 Min.	15.0 Min.	dB
—	Gain Flatness	±0.6	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	2.3	3.0 Max.	3.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+0.5	−2.0 Min.	−3.0 Min.	dBm
—	Input VSWR	<1.8:1	2.0:1 Max.	2.2:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+8.0	—	—	dBm
I_D	DC Current	10	—	—	mA

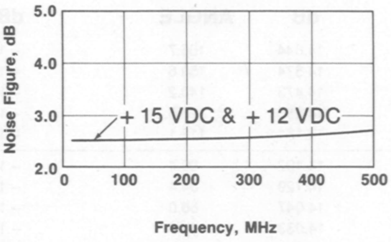
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

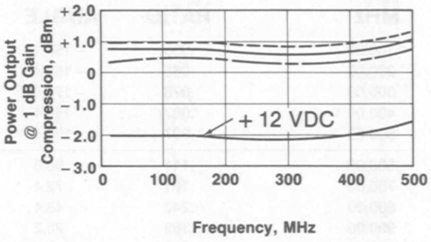
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

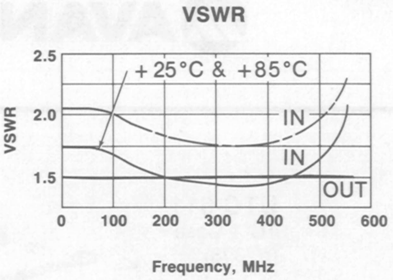
DC Voltage . . . . +17 Volts
Continuous RF Input Power . . . . +13 dBm
Operating Case Temperature . . . . −55°C to +125°C
Storage Temperature . . . . −62°C to +150°C
"R" Series Burn-In Temperature . . . . +125°C

THERMAL CHARACTERISTICS*

θ_{JC} . . . . 105°C/W
Active Transistor Power Dissipation . . . . 67 mW
Junction Temperature Above Case Temperature . . . . 7°C
MTBF . . . . 828,656 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	FLAT dB	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.69	17.39	147.77	– 5.69	– 4.04	.06	—	1.51	23.07
150.0	1.59	17.28	133.10	– 1.67	– .64	.16	.86	1.52	22.97
200.0	1.49	17.31	116.89	.81	1.23	.14	.95	1.49	22.68
250.0	1.39	17.33	99.01	1.63	1.43	.06	.96	1.50	22.64
300.0	1.33	17.51	52.39	3.71	2.89	– .06	.98	1.49	22.49
350.0	1.34	17.50	63.82	3.83	2.39	– .05	1.04	1.53	22.42
400.0	1.40	17.58	45.07	3.79	1.73	– .12	1.07	1.53	22.29
450.0	1.54	17.61	25.35	2.77	.09	– .16	1.19	1.53	21.69
500.0	1.79	17.49	2.11	– 1.78	– 5.08	– .04	1.32	1.54	22.32
550.0	2.16	17.06	– 22.23	– 7.42	—	—	1.43	1.50	22.09
600.0	2.97	16.03	– 49.43	—	—	—	1.45	1.37	23.18
LINEARIZATION RANGE:				100.0 TO 550.0	100.0 TO 500.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 RATIO	21 ANGLE	12 RATIO	12 ANGLE	22 RATIO	22 ANGLE
100.00	.202	166.7	7.432	145.8	.073	– 10.6	.176	163.1
200.00	.154	160.3	7.326	115.3	.074	– 24.3	.169	148.1
300.00	.121	168.4	7.389	81.6	.077	– 39.8	.171	135.8
400.00	.152	168.2	7.395	45.6	.077	– 58.4	.177	124.4
500.00	.229	122.5	7.464	4.7	.078	– 83.1	.206	105.6
600.00	.422	45.4	6.673	– 45.2	.068	– 114.4	.181	63.5
700.00	.706	– 24.1	4.415	– 95.6	.041	– 146.7	.081	– 35.8
800.00	.834	– 67.9	2.289	– 132.0	.019	– 159.1	.172	– 143.5
900.00	.886	– 95.7	1.252	– 155.8	.011	– 149.0	.292	– 178.7
1000.00	.907	– 112.7	.741	– 170.8	.007	– 131.4	.386	161.9

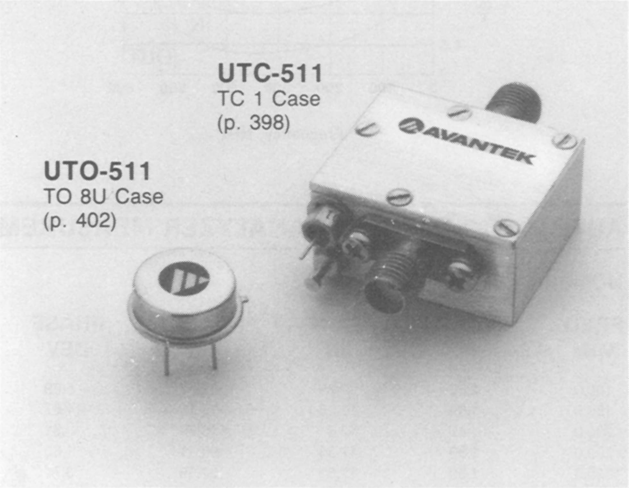
511 Series

Thin Film Cascadable Amplifier
5-500 MHz

AVANTEK

FEATURES

- **Low Noise: 2.3 dB**

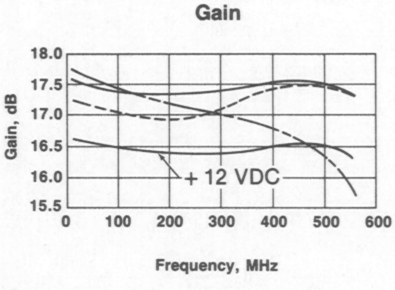


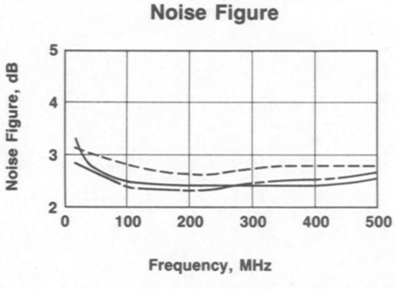
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

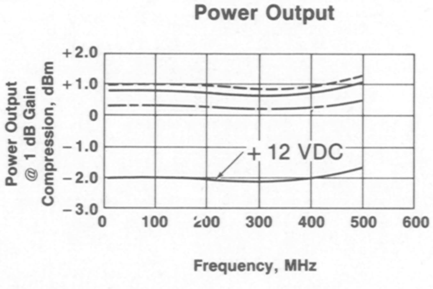
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
G_P	Small Signal Gain	17.5	15.0 Min.	15.0 Min.	dB
—	Gain Flatness	±0.6	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	2.3	2.5 Max.	3.0 Max.	dB
P_{1dB}	Power Output @ + 1 dB Compression	+0.5	−2.0 Min.	−3.0 Min.	dBm
—	Input VSWR	<1.8:1	2.0:1 Max.	2.2:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+8.0	—	—	dBm
I_D	DC Current	10	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ———
+85°C — — —
−55°C —·—·—


Gain


Noise Figure


Power Output

MAXIMUM RATINGS

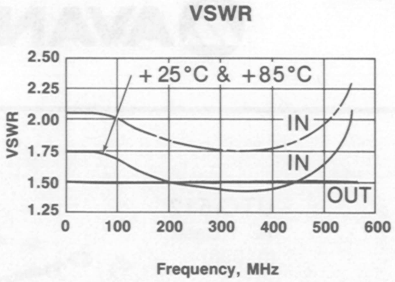
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	105°C/W
Active Transistor Power Dissipation	67 mW
Junction Temperature Above Case Temperature	7°C
MTBF	828,656 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	FLAT dB	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.69	17.39	147.77	– 5.69	– 4.04	.06	—	1.51	23.07
150.0	1.59	17.28	133.10	– 1.67	– .64	.16	.86	1.52	22.97
200.0	1.49	17.31	116.89	.81	1.23	.14	.95	1.49	22.68
250.0	1.39	17.38	99.01	1.63	1.43	.06	.96	1.50	22.64
300.0	1.33	17.51	82.39	3.71	2.89	– .06	.98	1.49	22.49
350.0	1.34	17.50	63.82	3.83	2.39	– .05	1.04	1.53	22.42
400.0	1.40	17.58	45.07	3.79	1.73	– .12	1.07	1.53	22.29
450.0	1.54	17.61	25.35	2.77	.09	– .16	1.19	1.53	21.69
500.0	1.79	17.49	2.11	– 1.78	– 5.08	– .04	1.32	1.54	22.32
550.0	2.16	17.06	– 22.23	– 7.42	—	—	1.43	1.50	22.09
600.0	2.97	16.03	– 49.43	—	—	—	1.45	1.37	23.18
LINEARIZATION RANGE:				100.0 TO 500.0	100.0 TO 550.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 RATIO	21 ANGLE	12 RATIO	12 ANGLE	22 RATIO	22 ANGLE
100.00	.202	166.7	7.432	145.8	.073	– 10.6	.176	163.1
200.00	.154	160.3	7.326	115.3	.074	– 24.3	.169	148.1
300.00	.121	168.4	7.389	81.6	.077	– 39.8	.171	135.8
400.00	.152	168.2	7.395	45.6	.077	– 58.4	.177	124.4
500.00	.229	122.5	7.404	4.7	.078	– 83.1	.206	105.6
600.00	.422	45.4	6.673	– 45.2	.068	– 114.4	.181	63.5
700.00	.706	– 24.1	4.415	– 95.6	.041	– 146.7	.081	– 35.8
800.00	.834	– 67.9	2.289	– 132.0	.019	– 159.1	.172	– 143.5
900.00	.886	– 95.7	1.252	– 155.8	.011	– 149.0	.292	– 178.7
1000.00	.907	– 112.7	.741	– 170.8	.007	– 131.4	.386	161.9

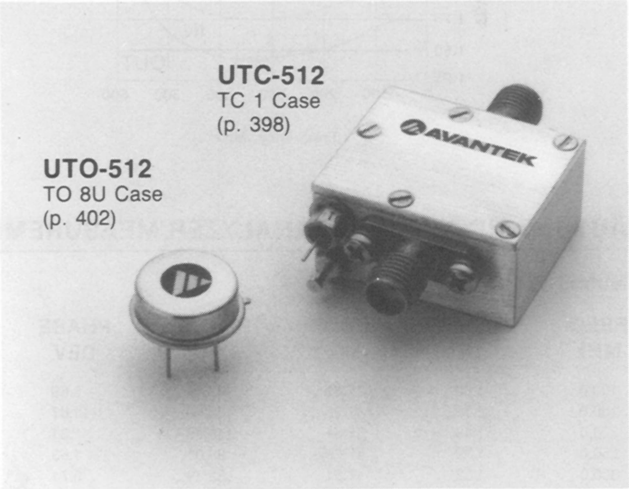
512 Series

Thin Film Cascadable Amplifier
5-500 MHz

AVANTEK

FEATURES

- **Medium Gain: 20.5 dB**



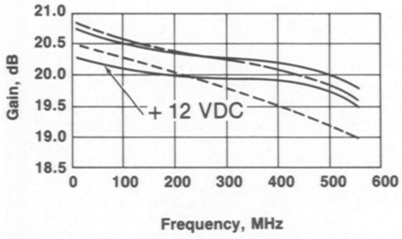
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = -55°- +85°C	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	20.5	20.0 Min.	19.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	2.5	3.0 Max.	3.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+8.0	+7.0 Min.	+7.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.5:1 Max.	—
—	Output VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+20.0	—	—	dBm
I_D	DC Current	23	—	—	mA

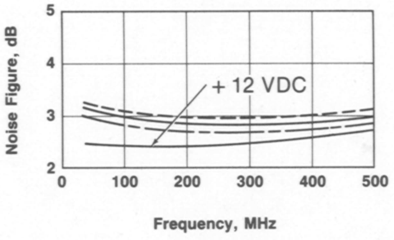
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
-55°C —·—·—

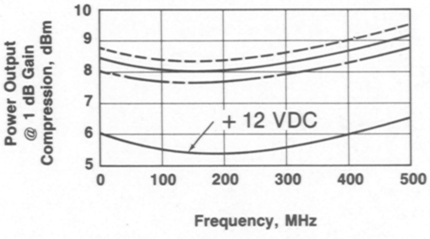
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

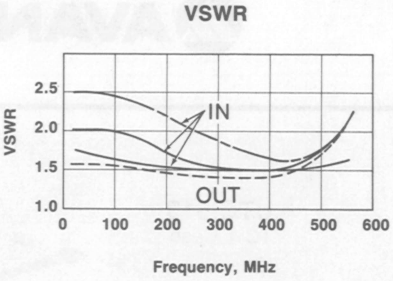
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	-55°C to +125°C
Storage Temperature	-62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	155°C/W
Active Transistor Power Dissipation	150 mW
Junction Temperature Above Case Temperature	23°C
MTBF	931,338 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	FLAT dB	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.43	21.18	142.44	– 2.74	– 1.88	– .41	—	1.29	26.76
150.0	1.42	20.97	125.36	– .50	.03	– .21	.99	1.29	26.01
200.0	1.40	20.82	106.77	.22	.44	– .06	1.06	1.27	26.79
250.0	1.39	20.78	87.38	.15	.04	– .01	1.03	1.27	26.25
300.0	1.35	20.75	69.83	1.92	1.49	.00	1.03	1.27	26.20
350.0	1.30	20.67	50.31	1.74	.99	.09	1.06	1.28	26.21
400.0	1.25	20.59	31.56	2.31	1.24	.16	1.07	1.27	27.19
450.0	1.24	20.58	11.79	1.88	.48	.17	1.17	1.23	26.20
500.0	1.39	20.48	– 10.56	– 1.13	– 2.85	.27	1.23	1.24	26.85
550.0	1.74	20.24	– 32.64	– 3.87	—	—	1.30	1.26	26.70
600.0	2.39	19.76	– 57.33	—		—	1.35	1.32	27.94
LINEARIZATION RANGE:				100.0 TO 550.0	100.0 TO 500.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
100.00	.171	135.7	10.825	141.5	.046	– 10.8	.085	179.3
200.00	.171	135.7	10.825	141.5	.046	– 10.8	.085	179.3
300.00	.143	65.8	10.562	71.1	.047	– 39.9	.122	146.8
400.00	.119	64.0	10.505	33.1	.046	– 58.5	.131	116.1
500.00	.213	78.7	10.402	– 9.1	.046	– 82.4	.124	68.2
600.00	.454	55.5	9.614	– 55.1	.040	– 110.4	.133	– 20.2
700.00	.722	19.3	7.504	– 100.7	.027	– 143.0	.251	– 97.1
800.00	.851	– 12.3	4.945	– 142.8	.014	– 172.2	.386	– 145.3
900.00	.914	– 38.6	3.196	– 178.5	.005	166.1	.493	– 179.0
1000.00	.928	– 58.5	2.061	153.9	.001	4.9	.559	157.0

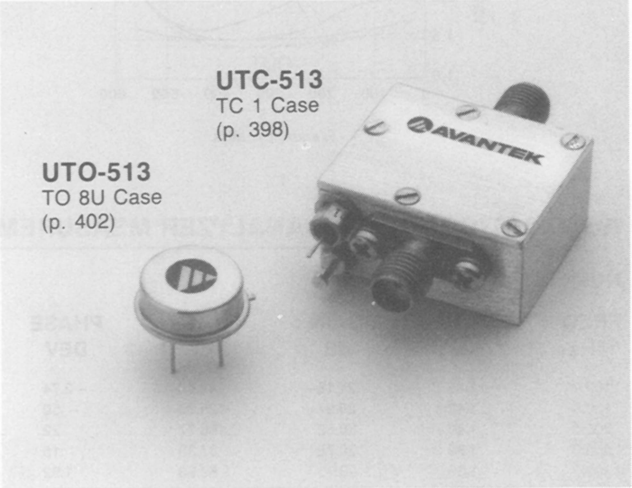
513 Series

Thin Film Cascadable Amplifier 5-500 MHz

AVANTEK

FEATURES

- **Medium Power Output: +16.0 dBm**
- **Medium Gain: 17 dB**
- **24 Volt Bias**



UTC-513
TC 1 Case
(p. 398)

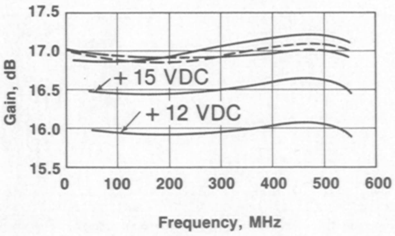
UTO-513
TO 8U Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +24 VDC nominal unless otherwise noted)

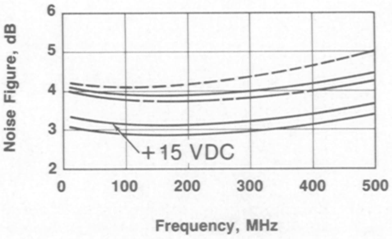
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	Guaranteed Specifications $T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	17.0	16.0 Min.	15.5 Min.	dB
	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.0	6.0 Max.	6.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+16.0	+14.0 Min.	+14.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	
IP_3	Two Tone 3rd Order Intercept Point	+31.0	—		dBm
IP_2	Two Tone 2nd Order Intercept Point	+42.0	—		dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+48.0	—	—	dBm
I_D	DC Current	50	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +24 VDC unless otherwise noted)

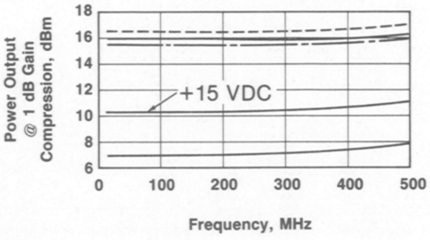
KEY: +25°C ————
+85°C — — — —
−55°C —·—·—



Gain



Noise Figure



Power Output

MAXIMUM RATINGS

DC Voltage	+26 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

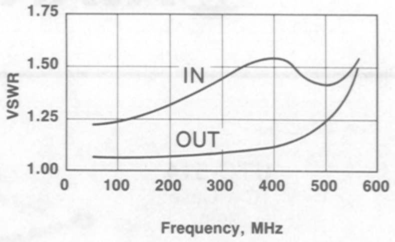
THERMAL CHARACTERISTICS*

θ_{JC}	105°C/W
Active Transistor Power Dissipation	260 mW
Junction Temperature Above Case Temperature	27°C
MTBF	1,091,556 Hrs.

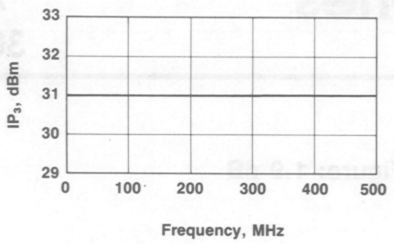
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

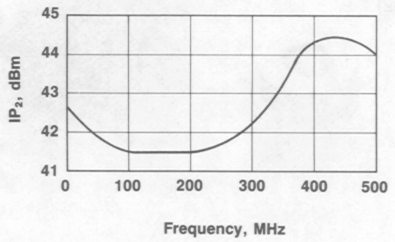
VSWR



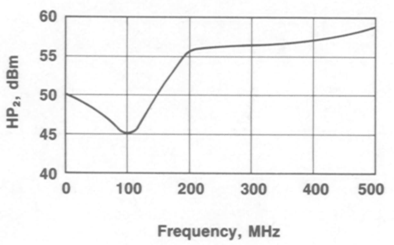
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmoninc Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 24.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.17	17.18	151.55	− 3.39	− 1.67	—	1.06	22.61
150.0	1.27	17.02	137.68	− 1.81	− .74	.79	1.08	22.75
200.0	1.36	17.00	123.18	− .85	− .42	.79	1.10	22.89
250.0	1.46	17.01	109.32	.75	.53	.76	1.12	22.97
300.0	1.54	17.07	95.67	2.57	1.71	.77	1.14	23.18
350.0	1.60	17.10	81.47	3.83	2.32	.81	1.15	23.30
400.0	1.59	17.19	66.50	4.32	2.17	.88	1.18	23.35
450.0	1.50	17.27	49.83	3.11	.31	1.00	1.24	23.17
500.0	1.40	17.32	30.47	− .77	− 4.21	1.16	1.34	22.66
550.0	1.59	16.95	8.04	− 7.74	—	1.29	1.50	22.00
600.0	2.38	15.83	− 15.82	—	—	1.28	1.69	21.58
650.0	3.83	13.95	− 37.86	—	—	1.11	1.84	21.84
LINEARIZATION RANGE:				100.0 TO 550.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 24 VOLTS**

FREQ MHz	11 RATIO	11 ANGLE	21 RATIO	21 ANGLE	12 RATIO	12 ANGLE	22 RATIO	22 ANGLE
100.00	.076	− 99.8	7.004	152.4	.073	− 10.7	.028	85.7
150.00	.112	− 107.9	6.952	139.2	.071	− 15.6	.038	68.8
200.00	.147	− 115.9	6.929	125.5	.070	− 21.4	.046	49.0
250.00	.179	− 126.2	6.961	111.6	.069	− 26.9	.052	28.9
300.00	.206	− 139.2	7.059	97.7	.069	− 31.9	.055	6.9
350.00	.225	− 154.5	7.160	83.5	.067	− 36.3	.058	− 21.7
400.00	.230	− 177.3	7.306	68.2	.067	− 40.0	.072	− 55.9
450.00	.219	147.4	7.435	50.6	.070	− 44.9	.102	− 89.5
500.00	.234	94.3	7.429	30.3	.075	− 51.0	.154	− 120.4
550.00	.339	36.6	7.023	7.0	.081	− 61.1	.222	− 148.7

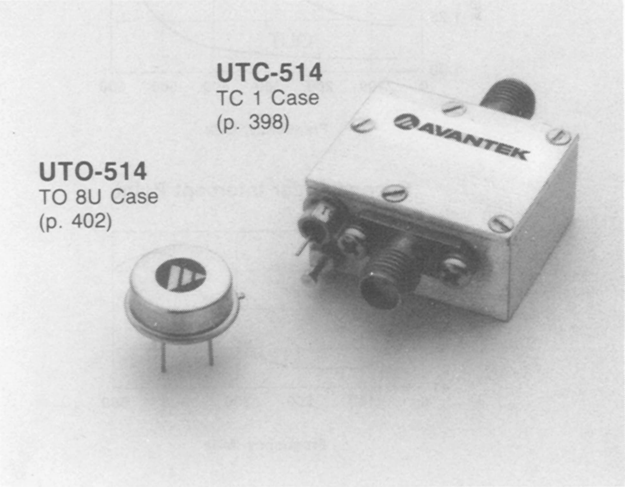
514 Series

Thin Film Cascadable Amplifier 30-200 MHz

AVANTEK

FEATURES

- **Low Noise Figure: 1.9 dB**



UTC-514
TC 1 Case
(p. 398)

UTO-514
TO 8U Case
(p. 402)

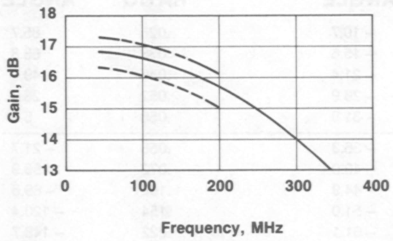
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-}+85°C$	
BW	Frequency Range	30-200	30-200	30-200	MHz
GP	Small Signal Gain	16.0	15.0 Min.	14.5 Min.	dB
—	Gain Flatness	±0.6	±0.75 Max.	±1.0 Max.	dB
NF	Noise Figure	1.9	2.0 Max.	2.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	−0.5	−3.0 Min.	−4.0 Min.	dBm
—	Input VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+7.0	—	—	dBm
I_D	DC Current	8	—	—	mA

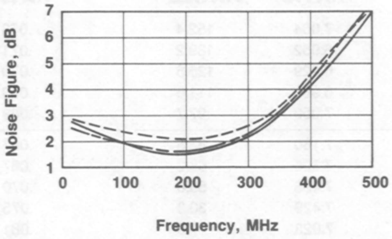
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

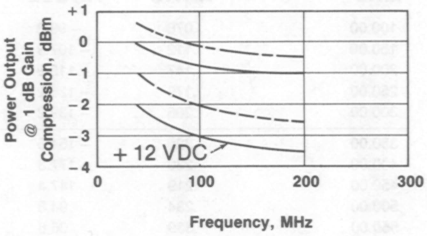
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

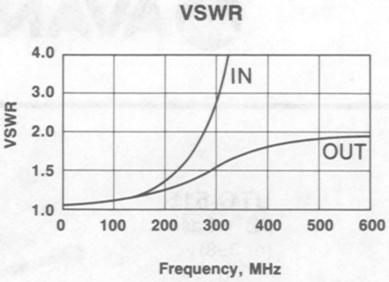
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	105°C/W
Active Transistor Power Dissipation	48 mW
Junction Temperature Above Case Temperature	5°C
MTBF	949,186 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.10	17.27	133.06	– .05	.00	1.02	21.48
150.0	1.04	16.96	109.07	.10	1.34	1.08	21.54
200.0	1.27	16.60	84.76	– .05	1.38	1.20	21.70
250.0	1.85	15.83	59.53	—	1.43	1.35	22.05
300.0	3.03	14.43	33.43	—	1.41	1.52	23.00
350.0	5.28	12.41	8.75	—	1.27	1.68	24.68
400.0	9.05	9.95	– 12.27	—	1.09	1.78	26.56
450.0	14.49	7.36	– 30.45	—	.90	1.80	28.93
500.0	20.02	4.77	– 44.59	—	.76	1.81	31.26
550.0	26.77	2.34	– 57.79	—	.71	1.82	33.57
600.0	31.74	.02	– 70.19	—	.64	1.79	35.66
650.0	35.25	– 2.20	– 80.94	—	.58	1.76	37.95
700.0	35.85	– 4.41	– 91.09	—	.50	1.73	40.62
750.0	34.56	– 6.60	– 99.01	—	.45	1.68	43.00
800.0	34.79	– 8.88	– 107.34	—	.42	1.59	45.33
850.0	35.62	– 11.19	– 114.25	—	.35	1.52	47.74
900.0	36.93	– 13.42	– 119.83	—	.28	1.46	49.86
950.0	37.46	– 15.58	– 124.40	—	.22	1.39	50.14
1000.0	38.85	– 17.63	– 127.82	—	.00	1.34	50.98

LINEARIZATION RANGE: 100.0 TO 200.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.124	174.0	16.543	136.3	– 21.930	– 19.9	.025	– 138.6
200.00	.191	90.5	15.776	92.6	– 21.865	– 42.2	.083	– 128.5
300.0	.457	11.5	13.823	47.6	– 22.705	– 71.8	.166	– 168.0
400.0	.743	– 38.4	9.941	5.6	– 25.462	– 100.3	.191	147.7
500.0	.869	– 66.8	5.135	– 24.6	– 29.152	– 119.0	.171	114.8
600.0	.924	– 83.4	.614	– 47.2	– 33.145	– 128.9	.126	85.8
700.0	.943	– 93.1	– 3.628	– 65.9	– 36.821	– 133.1	.071	56.1
800.0	.951	– 99.2	– 7.748	– 78.7	– 40.206	– 128.7	.019	– 24.5
900.0	.956	– 103.0	– 11.799	– 88.2	– 42.626	– 123.5	.052	– 138.8
1000.00	.962	– 104.9	– 15.452	– 94.0	– 44.026	– 119.3	.092	– 161.6

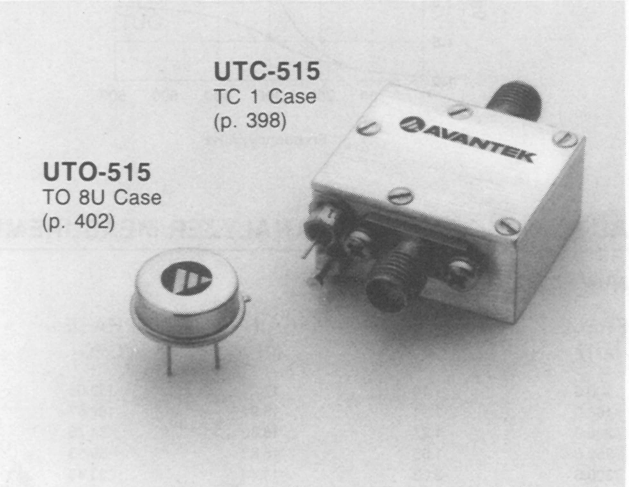
515 Series

Thin Film Cascadable Amplifier
2-500 MHz

AVANTEK

FEATURES

- **Medium Output Power: +16.0 dBm**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

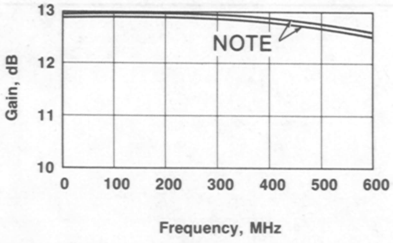
Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		T_C = 25°C	T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	2-500	2-500	2-500	MHz
GP	Small Signal Gain	13.0	12.0 Min.	11.0 Min.	dB
—	Gain Flatness	±0.2	±0.5 Max.	±0.7 Max.	dB
NF	Noise Figure	5.5	7.0 Max.	7.5 Max.	dB
$P_{1 dB}$	Power Output @ + 1 dB Compression	+16.0	+14.0 Min.	+13.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+28.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+40.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+46.0	—	—	dBm
I_D	DC Current	65	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

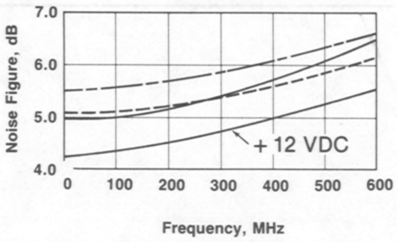
KEY:
+25°C ————
+85°C — — —
−55°C —·—·—

(Note: +15V at −55°C, +25°C and +85°C and +12 VDC at 25°C falls within the indicated limits)

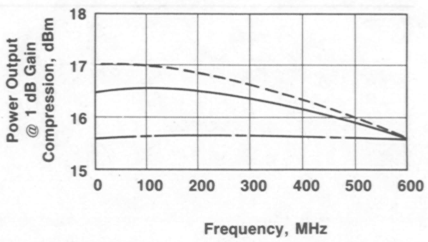
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +85°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+85°C

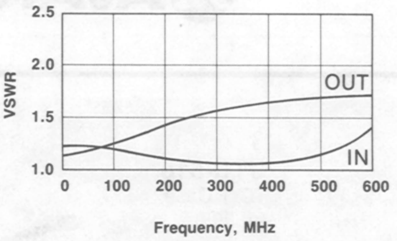
THERMAL CHARACTERISTICS*

θ_{JC}	110°C/W
Active Transistor Power Dissipation	600 mW
Junction Temperature Above Case Temperature	72°C
MTBF	1,064,661 Hrs.

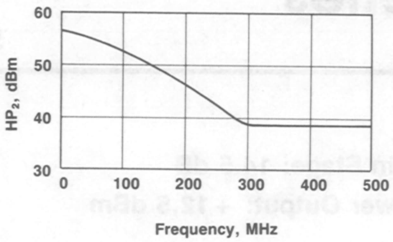
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

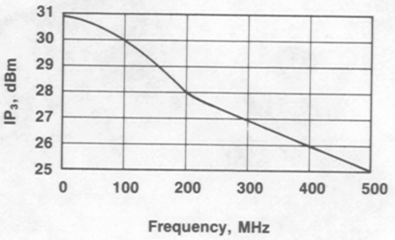
VSWR



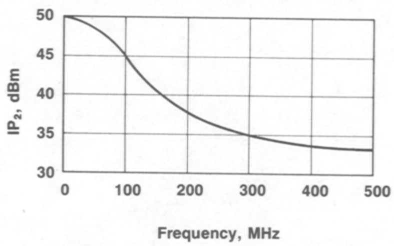
Second Harmonic Intercept Point



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS — **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.21	12.87	152.97	−.70	—	1.30	21.72
150.0	1.20	12.86	139.61	−.60	.73	1.31	21.72
200.0	1.17	12.70	126.69	−.05	.72	1.31	21.69
250.0	1.14	12.70	113.72	.44	.72	1.33	21.67
300.0	1.11	12.64	100.88	1.06	.73	1.36	21.59
350.0	1.10	12.61	87.30	.95	.77	1.40	21.50
400.0	1.11	12.59	73.33	.45	.78	1.46	21.47
450.0	1.16	12.63	59.29	−.12	.80	1.55	21.40
500.0	1.25	12.71	44.50	−1.44	.83	1.67	21.39
550.0	1.37	12.76	29.34	—	.87	1.84	21.47
600.0	1.55	12.82	13.21	—	.98	2.09	21.63
LINEARIZATION RANGE:				100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES — **BIAS = 15 VOLTS**

FREQ MHz	11		21		12		22	
	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
100.00	.112	−18.6	4.551	151.4	.084	−14.1	.129	164.5
200.00	.090	−36.8	4.454	127.3	.084	−30.4	.133	146.1
300.00	.059	−42.3	4.451	100.2	.087	−47.6	.153	123.9
400.00	.036	5.2	4.406	72.5	.086	−67.5	.185	98.1
500.00	.094	42.2	4.383	44.0	.087	−90.9	.248	71.4
600.00	.208	37.1	4.394	12.7	.086	−115.5	.347	40.9
700.00	.408	20.4	4.389	−24.7	.076	−146.1	.487	7.2
800.00	.680	−5.2	3.673	−70.2	.052	−178.5	.549	−25.8
900.00	.880	−37.3	2.372	−115.2	.029	167.8	.523	−48.5
1000.00	.927	−61.4	1.339	−143.1	.022	166.8	.554	−58.6

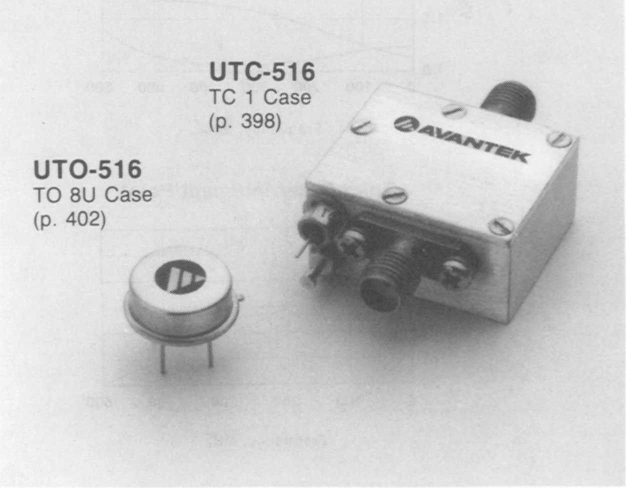
516 Series

Thin Film Cascadable Amplifier 5-500 MHz

AVANTEK

FEATURES

- **Medium Gain Stage: 14.5 dB**
- **Medium Power Output: +12.5 dBm**


UTC-516
TC 1 Case
(p. 398)

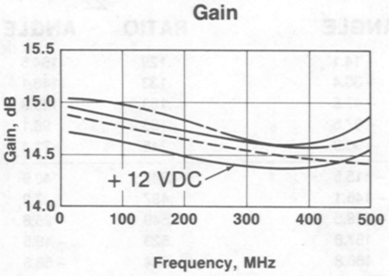
UTO-516
TO 8U Case
(p. 402)

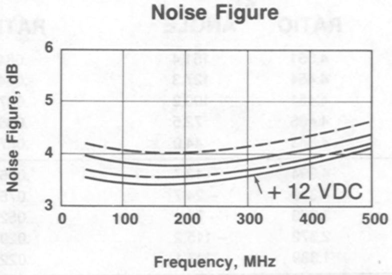
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

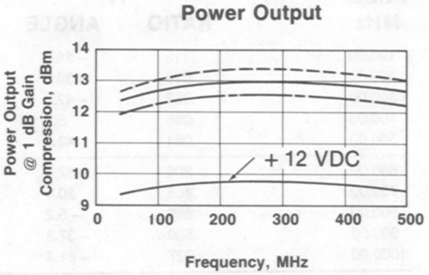
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	T_C = −55°- +85°C	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	14.5	14.0 Min.	13.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.0	4.5 Max.	5.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+12.5	+10.0 Min.	+9.5 Min.	dBm
—	Input VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+23.0	—	—	dBm
I_D	DC Current	35	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C — · — · —







MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

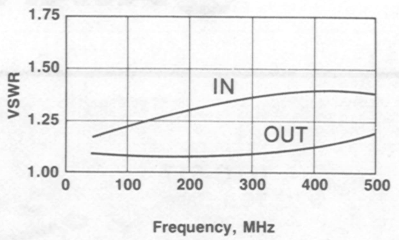
THERMAL CHARACTERISTICS*

θ_{JC}	105°C/W
Active Transistor Power Dissipation	180 mW
Junction Temperature Above Case Temperature	19°C
MTBF	952,502 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

VSWR



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.28	15.18	153.37	−.99	—	1.05	21.18
150.0	1.35	15.11	140.76	−.73	.69	1.07	21.29
200.0	1.41	14.87	128.36	−.27	.68	1.09	21.44
250.0	1.46	14.81	116.28	.50	.67	1.09	21.50
300.0	1.46	14.74	104.19	1.27	.68	1.09	21.62
350.0	1.43	14.66	91.64	1.58	.72	1.10	21.69
400.0	1.36	14.69	78.41	1.22	.76	1.10	21.81
450.0	1.23	14.81	64.34	.01	.82	1.13	21.88
500.0	1.09	14.97	48.89	−2.57	.92	1.18	21.95
550.0	1.26	15.07	31.40	—	1.03	1.27	21.99
600.0	1.78	14.88	11.85	—	1.16	1.38	22.10
LINEARIZATION RANGE:				100.0 TO 500.0	100.0 TO 500.0		

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 RATIO	21 ANGLE	12 RATIO	12 ANGLE	22 RATIO	22 ANGLE
100.00	.098	−77.5	5.623	152.8	.088	−11.5	.024	63.3
200.00	.155	−110.0	5.449	130.3	.085	−24.3	.043	39.2
300.00	.173	−130.4	5.403	105.1	.084	−37.0	.048	10.5
400.00	.140	−152.4	5.405	78.9	.079	−49.4	.045	−37.6
500.00	.023	135.4	5.523	50.3	.077	−63.5	.068	−105.6
600.00	.270	−15.7	5.396	13.3	.076	−78.4	.144	−152.8
700.00	.648	−58.7	4.247	−29.8	.068	−97.6	.232	166.7
800.00	.837	−92.4	2.517	−62.9	.054	−116.4	.284	138.9
900.00	.906	−114.6	1.467	−84.7	.042	−130.8	.314	121.7
1000.00	.919	−127.5	.915	−98.1	.032	−138.8	.338	109.5

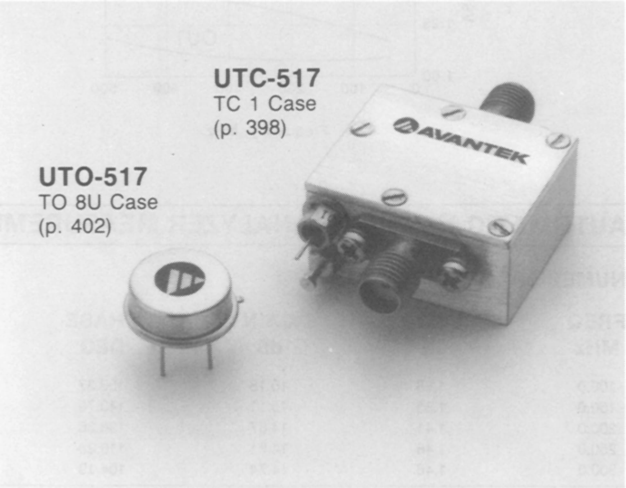
517 Series

Thin Film Cascadable Amplifier
5-500 MHz

AVANTEK

FEATURES

- **High Gain: 22.5 dB**
- **Low Noise Figure: 2.0 dB**



UTC-517
TC 1 Case
(p. 398)

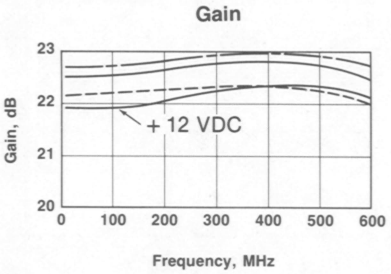
UTO-517
TO 8U Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

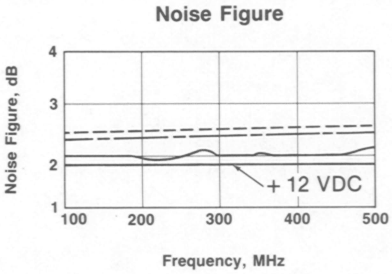
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = -55°- +85°C	
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	22.5	22.5 Min.	21.0 Min.	dB
	Gain Flatness	±0.2	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	2.0	2.5 Max.	3.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+8.0	+5.0 Min.	+4.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+15.0	—	—	dBm
I_D	DC Current	22	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

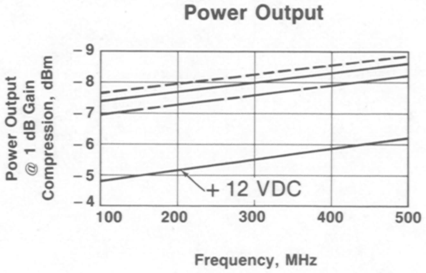
KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—·—



Gain



Noise Figure



Power Output

MAXIMUM RATINGS

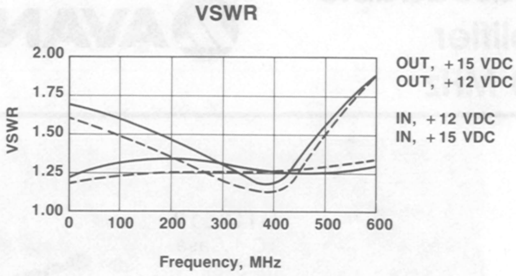
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... -55°C to +125°C
Storage Temperature .... -62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 120°C/W
Active Transistor Power Dissipation .... 170 mW
Junction Temperature Above Case Temperature .... 20°C
MTBF .... 993,691 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.28	22.94	162.63	.00	1.45	30.99
150.0	1.29	23.02	152.17	.53	1.46	31.12
200.0	1.31	23.05	143.42	.49	1.48	31.07
250.0	1.35	23.01	134.43	.51	1.49	31.11
300.0	1.37	22.98	124.92	.54	1.51	31.10
350.0	1.39	22.99	115.09	.55	1.54	31.08
400.0	1.40	22.99	104.99	.58	1.57	31.02
450.0	1.38	22.99	94.37	.61	1.61	31.00
500.0	1.33	22.90	83.14	.63	1.64	30.92
550.0	1.27	22.83	71.63	.65	1.69	30.84
600.0	1.19	22.73	59.82	.66	1.76	30.71
650.0	1.12	22.56	47.78	.69	1.82	30.63
700.0	1.13	22.33	35.10	.70	1.90	30.58
750.0	1.24	22.05	22.51	.70	2.03	30.56
800.0	1.41	21.61	9.98	.72	2.19	30.52
850.0	1.62	20.99	–3.46	.75	2.41	30.50
900.0	1.88	20.29	–17.10	.78	2.73	30.64
950.0	2.22	19.39	–31.45	.81	3.18	30.81
1000.0	2.63	18.26	–46.31	.00	3.72	31.25

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.156	151.8	23.049	164.9	–29.646	11.1	.080	1.4
150.00	.165	134.6	22.612	156.1	–31.278	–1.1	.083	–2.8
200.00	.163	117.0	22.681	149.0	–31.053	11.2	.092	–6.1
250.00	.151	106.0	22.747	139.8	–30.067	7.7	.099	–12.5
300.00	.139	92.3	22.790	132.5	–29.378	4.9	.105	–17.7
350.00	.113	85.1	22.901	123.8	–28.143	2.5	.116	–30.6
400.00	.086	74.2	22.835	115.4	–28.370	–9.2	.091	–40.1
450.00	.044	85.4	22.943	106.1	–28.829	–18.9	.103	–64.7
500.00	.040	152.1	22.835	95.6	–29.833	–30.2	.112	–96.1
550.00	.103	170.1	22.789	85.7	–32.217	–33.6	.113	–126.6
600.00	.180	162.9	22.533	73.9	–35.323	–31.2	.110	–154.6
650.00	.258	152.0	21.994	62.9	–37.411	–11.6	.109	–175.3
700.00	.333	139.2	21.359	51.8	–37.387	7.1	.112	169.4
750.00	.397	127.4	20.542	41.2	–36.298	20.2	.121	156.1
800.00	.447	116.4	19.483	31.7	–35.465	25.3	.133	148.6
850.00	.489	106.2	18.590	23.8	–34.078	34.4	.150	140.3
900.00	.523	97.3	17.554	16.5	–33.008	31.6	.170	134.9
950.00	.547	89.7	16.496	10.4	–32.089	39.5	.190	130.3
1000.00	.563	81.9	15.739	4.6	–31.007	39.5	.215	126.9

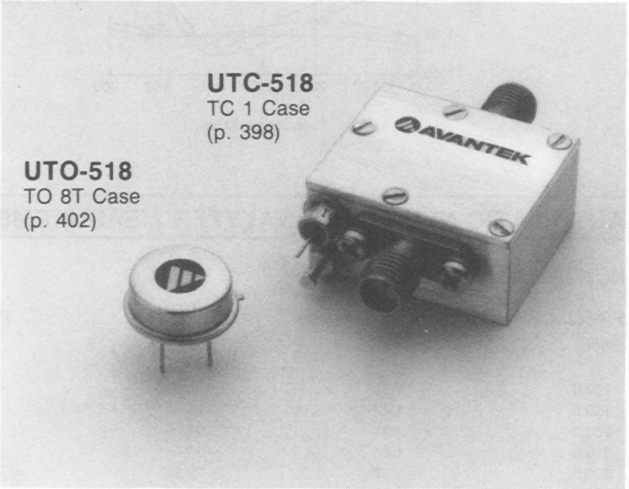
518 Series

Thin Film Cascadable Amplifier 5-500 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **+24.5 dBm Output Power**
- **5.5 dB Noise Figure**



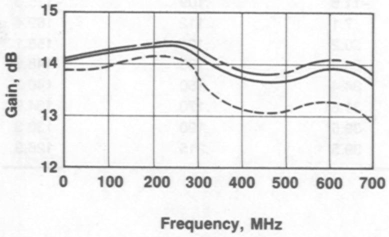
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	13.7	13.0 Min.	12.0 Min.	dB
—	Gain Flatness	±0.4	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	5.5	6.0 Max.	6.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+24.5	+23.0 Min.	+22.0 Min.	dBm
—	Input VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+35.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+42.0	—	—	dBm
I_D	DC Current	130	—	—	mA

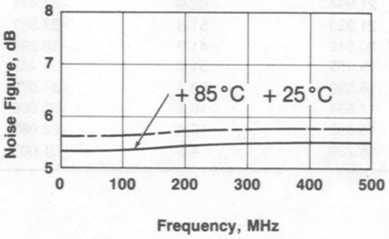
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ———
+85°C — — —
−55°C —·—·—

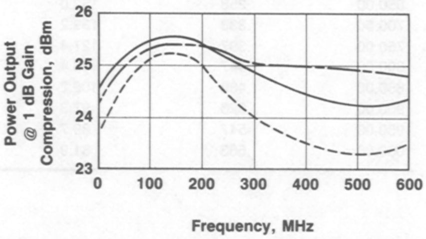
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

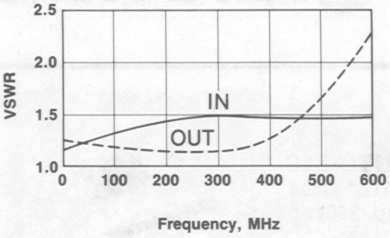
DC Voltage .... +17 Volts
Continuous RF Input Power .... +15 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +100°C

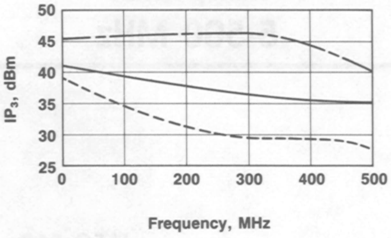
THERMAL CHARACTERISTICS*

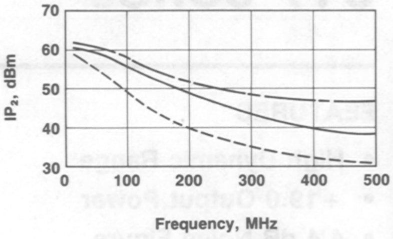
θ_{JC} .... 45°C/W
Active Transistor Power Dissipation .... 1160 mW
Junction Temperature Above Case Temperature .... 52°C
MTBF .... 505,356 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams


VSWR


Third-Order Intercept Point


Second-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.17	14.40	165.43	– .32	.00	1.08	18.69
150.0	1.21	14.36	158.09	– .33	.39	1.09	18.59
200.0	1.27	14.29	151.34	.26	.39	1.12	18.59
250.0	1.32	14.20	143.97	.25	.41	1.15	18.53
300.0	1.36	14.13	136.63	.25	.41	1.19	18.41
350.0	1.38	13.99	129.39	.35	.41	1.25	18.40
400.0	1.38	13.92	121.85	.15	.43	1.31	18.29
450.0	1.37	13.83	114.01	– .34	.42	1.39	18.17
500.0	1.36	13.82	106.71	– .28	.41	1.48	18.00
550.0	1.33	13.81	99.10	—	.44	1.60	17.70
600.0	1.30	13.71	90.88	—	.45	1.73	17.52
650.0	1.31	13.62	82.75	—	.49	1.87	17.30
700.0	1.41	13.49	73.14	—	.56	2.06	17.08
750.0	1.58	13.34	62.54	—	.59	2.29	16.95
800.0	1.84	13.12	51.78	—	.61	2.52	16.82
850.0	2.25	13.00	40.42	—	.62	2.76	16.92
900.0	2.89	12.54	29.38	—	.63	2.95	17.07
950.0	3.79	11.91	17.68	—	.71	3.00	17.62
1000.0	4.95	10.98	3.94	—	.68	3.04	18.33
1050.0	6.40	9.85	– 6.93	—	.63	3.01	19.17
1100.0	8.02	8.44	– 18.71	—	.59	2.88	20.34
1150.0	9.71	6.69	– 28.13	—	.47	2.78	21.58
1200.0	10.92	5.12	– 35.58	—	.44	2.71	22.48
1250.0	11.15	3.31	– 43.89	—	.38	2.61	24.26
1300.0	11.89	1.57	– 49.19	—	.34	2.57	25.36
1350.0	13.26	– .09	– 56.00	—	.33	2.57	26.85
1400.0	13.98	– 2.16	– 60.92	—	.22	2.57	28.28
1450.0	13.44	– 3.86	– 63.83	—	.23	2.58	29.32
1500.0	13.12	– 5.73	– 69.36	—	.00	2.61	30.23

LINEARIZATION RANGE: 100.0 TO 500.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.076	– 123.7	14.377	164.3	– 18.750	– 3.5	.034	– 161.9
200.00	.118	– 134.3	14.274	149.0	– 18.502	– 7.2	.058	– 125.5
300.00	.147	– 149.8	14.131	133.4	– 18.527	– 12.6	.091	– 118.0
400.00	.158	– 168.2	13.922	117.3	– 18.373	– 18.6	.139	– 118.6
500.00	.149	165.6	13.813	101.1	– 18.033	– 26.2	.199	– 125.0
600.00	.126	124.1	13.710	84.4	– 17.551	– 35.1	.269	– 135.7
700.00	.166	64.8	13.498	65.5	– 17.049	– 46.1	.350	– 151.1
800.00	.287	15.7	13.169	43.1	– 16.802	– 60.0	.434	– 171.8
900.00	.478	– 17.3	12.596	19.0	– 17.038	– 76.5	.497	161.8
1000.00	.665	– 45.4	11.060	– 7.0	– 18.179	– 96.7	.509	128.8
1100.00	.782	– 68.2	8.471	– 30.7	– 20.168	– 112.6	.494	96.1
1200.00	.835	– 84.2	5.222	– 49.4	– 22.480	– 124.5	.468	65.8
1300.00	.856	– 96.3	1.693	– 63.9	– 25.430	– 133.4	.444	38.9
1400.00	.869	– 104.2	– 1.998	– 77.6	– 28.284	– 141.4	.440	15.2
1500.00	.877	– 109.5	– 5.585	– 86.9	– 30.265	– 143.2	.450	– 5.3
1600.00	.870	– 113.9	– 9.402	– 94.7	– 32.729	– 143.8	.449	– 25.3
1700.00	.886	– 117.4	– 13.255	– 99.8	– 34.313	– 142.5	.461	– 48.4
1800.00	.876	– 120.8	– 17.945	– 99.2	– 36.121	– 137.2	.466	– 73.6
1900.00	.920	– 124.1	– 23.880	– 82.9	– 37.257	– 136.2	.470	– 103.5
2000.00	.909	– 126.6	– 24.890	– 43.7	– 38.152	– 134.5	.475	– 137.7

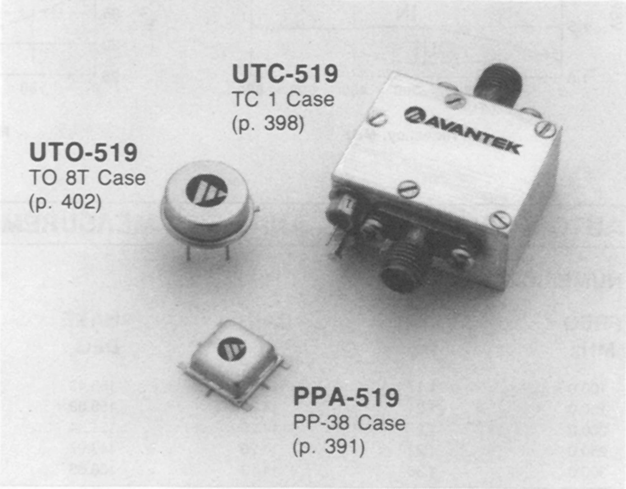
519 Series

Thin Film Cascadable Amplifier
5-500 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **+19.0 Output Power**
- **4.4 dB Noise Figure**



UTC-519
TC 1 Case
(p. 398)

UTO-519
TO 8T Case
(p. 402)

PPA-519
PP-38 Case
(p. 391)

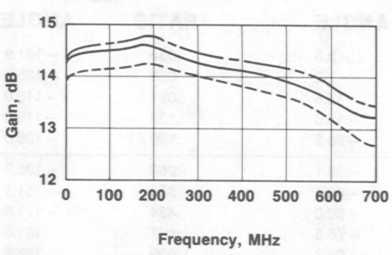
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		T_C = 25°C	T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	14.3	13.0 Min.	12.0 Min.	dB
—	Gain Flatness	±0.3	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	4.4	5.5 Max.	6.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+19.0	+18.0 Min.	+17.0 Min.	dBm
—	Input VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+33.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+40.0	—	—	dBm
I_D	DC Current	70	—	—	mA

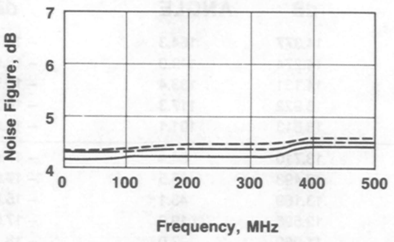
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
−55°C —·—·—

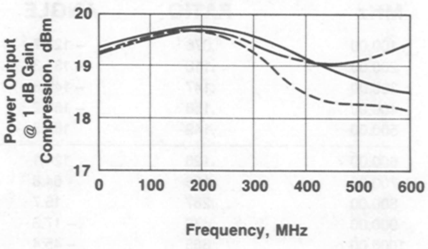
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

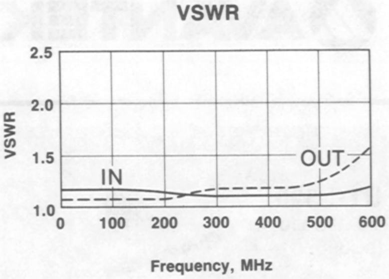
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +100°C

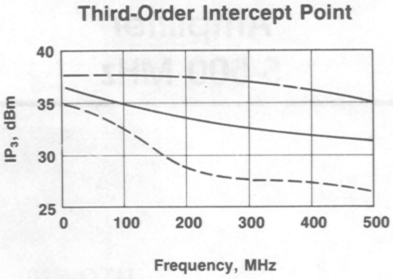
THERMAL CHARACTERISTICS*

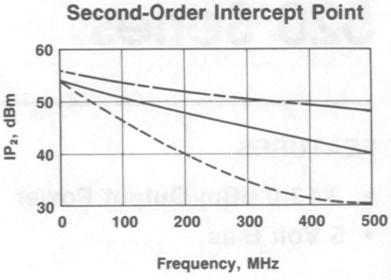
θ_{JC} .... 85°C/W
Active Transistor Power Dissipation .... 640 mW
Junction Temperature Above Case Temperature .... 54°C
MTBF .... 646,545 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) PPA — 0.5 grams; UTO — 2.1 grams; UTC — 21.5 grams







AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.07	14.86	166.21	−.29	.00	1.02	19.06
150.0	1.07	14.84	159.21	−.43	.37	1.03	18.88
200.0	1.08	14.77	152.92	.13	.36	1.04	19.03
250.0	1.08	14.68	146.17	.24	.37	1.06	19.09
300.0	1.07	14.60	139.50	.44	.38	1.09	19.12
350.0	1.06	14.48	132.61	.42	.39	1.13	19.17
400.0	1.04	14.38	125.62	.30	.40	1.17	19.25
450.0	1.04	14.30	118.19	−.27	.40	1.22	19.27
500.0	1.08	14.24	111.04	−.54	.39	1.28	19.27
550.0	1.14	14.20	104.00	—	.41	1.34	19.26
600.0	1.23	14.06	96.11	—	.43	1.41	19.22
650.0	1.35	13.87	88.55	—	.45	1.47	19.31
700.0	1.50	13.66	80.04	—	.49	1.53	19.37
750.0	1.68	13.41	70.84	—	.52	1.59	19.47
800.0	1.93	13.11	61.30	—	.52	1.63	19.46
850.0	2.27	12.87	52.03	—	.52	1.65	19.84
900.0	2.70	12.44	42.73	—	.52	1.65	19.93
950.0	3.26	11.85	33.36	—	.55	1.62	20.57
1000.0	3.99	11.18	22.87	—	.55	1.58	21.05
1050.0	4.79	10.27	13.61	—	.52	1.55	21.65
1100.0	5.82	9.26	4.24	—	.50	1.52	22.48
1150.0	6.98	7.96	−4.41	—	.45	1.50	23.38
1200.0	8.00	6.66	−12.05	—	.42	1.51	24.10
1250.0	8.80	5.23	−19.40	—	.36	1.53	25.42
1300.0	9.81	3.82	−25.15	—	.31	1.57	26.28
1350.0	11.49	2.45	−30.63	—	.29	1.62	27.57
1400.0	12.57	.82	−35.56	—	.24	1.67	28.80
1450.0	12.66	−.63	−39.43	—	.23	1.71	29.61
1500.0	12.82	−2.16	−43.90	—	.00	1.75	30.21

LINEARIZATION RANGE: 100.0 TO 500.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.034	−132.5	14.816	165.1	−18.942	−4.0	.012	92.9
200.00	.037	−132.6	14.737	150.5	−18.954	−10.3	.018	−4.2
300.00	.031	−133.2	14.587	136.0	−19.137	−16.5	.046	−29.2
400.00	.019	−98.7	14.366	120.9	−19.310	−23.4	.081	−53.1
500.00	.039	−22.5	14.208	105.2	−19.265	−31.4	.125	−72.9
600.00	.107	−21.7	14.044	89.4	−19.267	−39.9	.169	−92.2
700.00	.196	−27.2	13.645	72.2	−19.336	−49.2	.209	−112.3
800.00	.320	−39.3	13.122	52.2	−19.528	−60.0	.235	−135.5
900.00	.455	−52.3	12.451	32.1	−19.959	−71.7	.246	−162.1
1000.00	.600	−66.9	11.160	11.3	−21.060	−85.6	.223	165.4
1100.00	.709	−81.0	9.195	−8.4	−22.488	−98.3	.201	124.5
1200.00	.777	−92.8	6.628	−26.1	−24.144	−107.9	.198	82.8
1300.00	.823	−102.7	3.807	−40.1	−26.350	−115.9	.216	46.3
1400.00	.852	−109.8	.815	−52.0	−28.799	−124.2	.248	21.1
1500.00	.871	−114.9	−2.146	−61.2	−30.242	−128.0	.277	3.8
1600.00	.870	−119.4	−5.149	−69.7	−32.149	−131.4	.289	−9.4
1700.00	.891	−123.2	−7.756	−75.5	−33.359	−133.2	.297	−22.5
1800.00	.887	−127.1	−10.407	−79.7	−34.754	−131.2	.295	−33.8
1900.00	.937	−130.8	−13.149	−85.6	−35.497	−136.3	.288	−45.1
2000.00	.928	−133.9	−15.936	−90.3	−36.142	−139.2	.273	−60.5

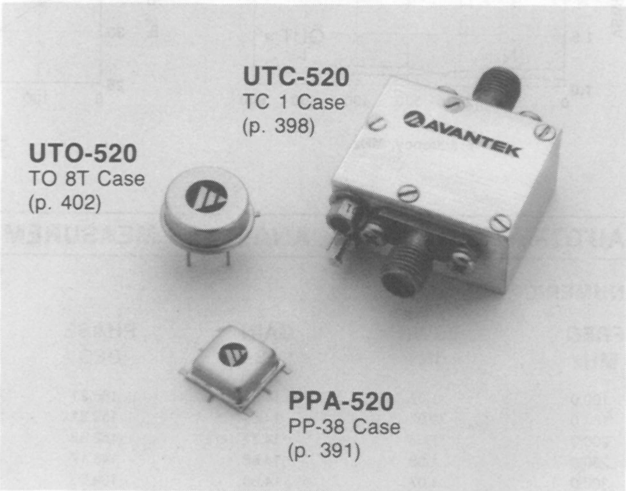
520 Series

Thin Film Cascadable Amplifier 5-500 MHz

AVANTEK

FEATURES

- +13.0 dBm Output Power
- 5 Volt Bias



UTC-520
TC 1 Case
(p. 398)

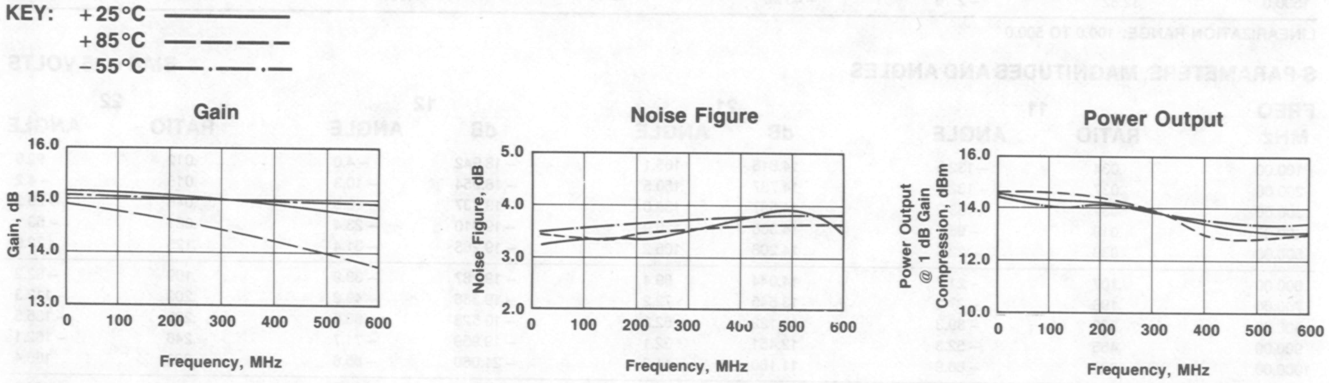
UTO-520
TO 8T Case
(p. 402)

PPA-520
PP-38 Case
(p. 391)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +5 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	Guaranteed Specifications $T_C = -55°\text{-}+85°C$	Unit
BW	Frequency Range	5-900	5-500	5-500	MHz
GP	Small Signal Gain	15.5	14.0 Min.	13.0 Min.	dB
—	Gain Flatness	±0.2	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	3.5	4.5 Max.	5.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+13.0	+12.0 Min.	+11.0 Min.	dBm
—	Input VSWR	<1.1:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+22.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+21.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+30.0	—	—	dBm
I_D	DC Current	33	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +5 VDC unless otherwise noted)



MAXIMUM RATINGS

DC Voltage	+10 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

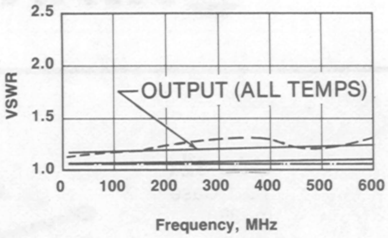
THERMAL CHARACTERISTICS*

θ_{JC}	105°C/W
Active Transistor Power Dissipation	108 mW
Junction Temperature Above Case Temperature	11.4°C

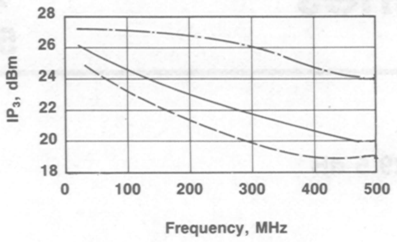
*For further information, see High Reliability section.

WEIGHT: (typical) PPA—0.5 grams; UTO—2.1 grams; UTC—21.5 grams

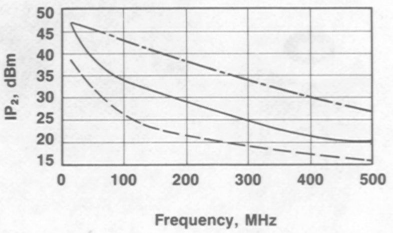
VSWR



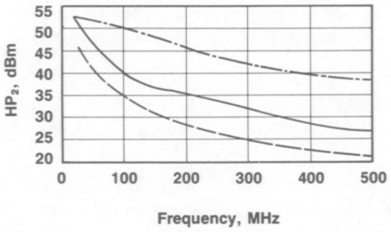
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 5.00 VOLTS

FREQ MHz	VSWR IN	PHASE DEG	GAIN dB	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.05	163.82	15.88	.55	.00	1.16	20.82
200.0	1.08	146.85	15.64	– .55	.45	1.17	19.74
300.0	1.08	131.42	15.48	– .12	.44	1.20	19.89
400.0	1.11	115.36	15.42	– .31	.43	1.21	20.09
500.0	1.11	100.25	15.44	.43	.42	1.24	19.82
600.0	1.10	85.10	15.44	—	.44	1.24	19.70
700.0	1.06	68.49	15.33	—	.49	1.23	19.25
800.0	1.07	49.52	15.18	—	.54	1.25	19.19
900.0	1.30	29.39	15.18	—	.57	1.32	19.14
1000.0	1.70	8.29	15.04	—	.62	1.49	19.05
1100.0	2.47	– 14.96	14.54	—	.68	1.82	19.45
1200.0	4.29	– 40.58	13.49	—	.72	2.29	19.94
1300.0	9.20	– 66.49	12.12	—	.72	2.77	21.27
1400.0	29.86	– 92.07	9.86	—	.68	3.31	22.51

LINEARIZATION RANGE: 100.0 TO 500.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 5.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.017	– 110.2	15.784	166.0	– 19.897	– 4.6	.084	9.2
200.00	.024	– 74.9	15.645	150.4	– 19.967	– 9.8	.099	3.3
300.00	.040	– 79.9	15.527	135.9	– 19.833	– 15.1	.111	– 7.3
400.00	.055	– 85.1	15.433	121.2	– 19.866	– 20.8	.121	– 21.9
500.00	.058	– 97.0	15.443	107.7	– 19.691	– 27.0	.125	– 38.3
600.00	.054	– 98.1	15.392	94.0	– 19.634	– 31.7	.127	– 59.4
700.00	.036	– 87.9	15.247	78.5	– 19.392	– 37.3	.120	– 88.8
800.00	.037	– 15.1	15.200	60.4	– 19.238	– 45.3	.122	– 132.2
900.00	.108	3.7	15.345	41.3	– 18.958	– 54.2	.159	179.3
1000.00	.225	– 6.3	15.210	19.3	– 18.894	– 66.3	.240	134.1
1100.00	.376	– 22.7	14.695	– 5.5	– 19.105	– 81.4	.368	95.7
1200.00	.537	– 42.2	13.294	– 31.6	– 19.936	– 93.7	.484	62.6
1300.00	.655	– 60.7	11.020	– 56.7	– 21.578	– 107.8	.554	32.2
1400.00	.733	– 77.1	7.779	– 81.2	– 23.721	– 119.3	.586	6.9
1500.00	.776	– 89.7	4.409	– 101.3	– 25.143	– 123.6	.588	– 13.5
1600.00	.793	– 99.8	.829	– 116.6	– 27.134	– 128.0	.570	– 30.3
1700.00	.793	– 108.2	– 3.026	– 130.0	– 28.339	– 128.6	.566	– 44.5
1800.00	.792	– 115.5	– 7.425	– 140.9	– 29.546	– 126.0	.564	– 55.4
1900.00	.797	– 122.2	– 13.994	– 147.4	– 29.889	– 129.9	.562	– 65.1
2000.00	.806	– 127.7	– 23.981	– 117.9	– 30.912	– 134.1	.568	– 74.8

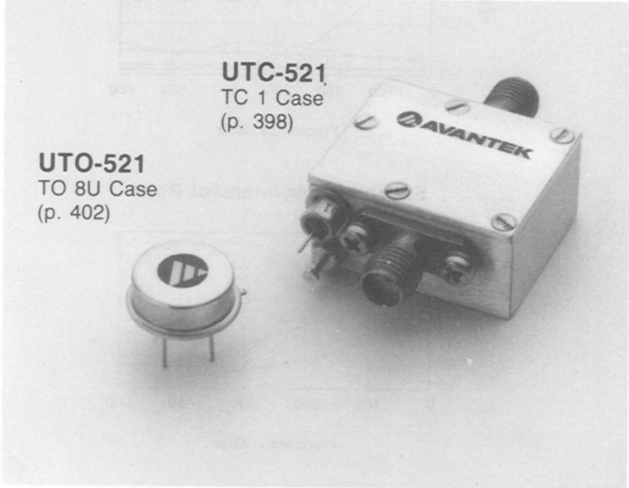
521 Series

Thin Film Cascadable Amplifier
5-500 MHz

AVANTEK

FEATURES

- **High Gain: 29.5 dB**

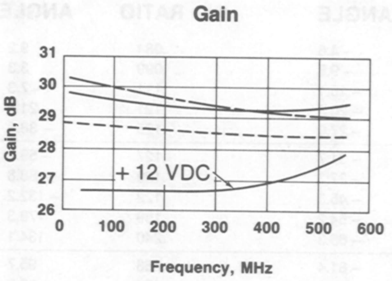


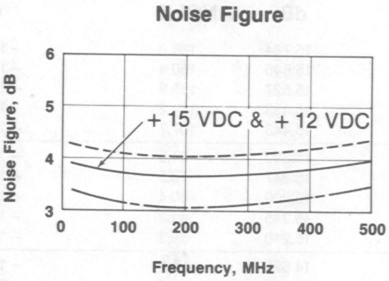
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

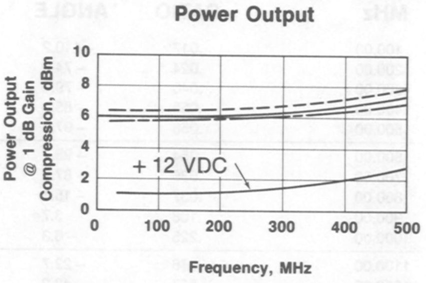
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	29.5	27.0 Min.	27.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	3.5	4.0 Max.	4.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+6.0	+6.0 Min.	+5.5 Min.	dBm
—	Input VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+18.0	—	—	dBm
I_D	DC Current	38	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

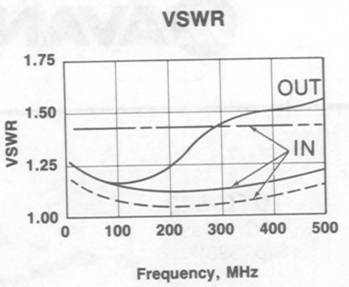
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	155/155°C/W
Active Transistor Power Dissipation	16/92 mW
Junction Temperature Above Case Temperature	2.5/14°C
MTBF	1,236,047 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25° ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.18	29.70	– 40.33	– 2.71	– 1.00	—	1.21	40.97
150.0	1.19	29.54	– 60.48	– 1.41	– .30	1.14	1.20	44.03
200.0	1.17	29.46	– 81.53	– 1.00	– .48	1.15	1.23	40.56
250.0	1.18	29.51	– 102.04	– .06	– .14	1.10	1.26	42.06
300.0	1.17	29.47	– 121.05	2.37	1.70	1.11	1.29	43.10
350.0	1.16	29.37	– 141.86	3.02	1.75	1.17	1.31	45.12
400.0	1.14	29.31	– 163.32	3.00	1.14	1.22	1.30	41.91
450.0	1.13	29.36	174.20	1.98	– .47	1.25	1.32	41.00
500.0	1.14	29.55	151.64	.88	– 2.17	1.27	1.40	39.90
550.0	1.20	29.55	128.62	– .67	—	1.37	1.52	38.51
600.0	1.40	29.46	102.45	– 5.39	—	1.53	1.80	40.82
650.0	1.85	29.09	73.62	—	—	1.67	2.29	44.57
700.0	2.62	28.35	42.43	—	—	1.68	3.14	40.06
LINEARIZATION RANGE:				100.00 TO 600.0	100.00 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 RATIO	21 ANGLE	12 RATIO	12 ANGLE	22 RATIO	22 ANGLE
100.00	.150	154.7	28.590	– 42.4	.005	3.8	.186	.4
200.00	.135	131.6	28.251	– 81.3	.006	– 6.3	.176	– 1.3
300.00	.123	105.4	28.358	– 119.2	.007	– 15.7	.155	– 2.0
400.00	.106	85.5	28.368	– 160.4	.007	– 20.6	.115	2.1
500.00	.106	86.8	29.566	156.1	.008	– 34.7	.062	40.2
600.00	.219	91.1	29.812	108.2	.009	– 53.4	.164	100.8
700.00	.506	57.2	27.417	49.0	.009	– 89.9	.423	84.8
800.00	.772	14.6	18.164	– 9.4	.006	– 131.8	.628	55.0
900.00	.886	– 21.7	9.986	– 57.7	.003	– 157.5	.681	30.6
1000.00	.910	– 47.2	5.417	– 93.3	.001	161.1	.663	14.5

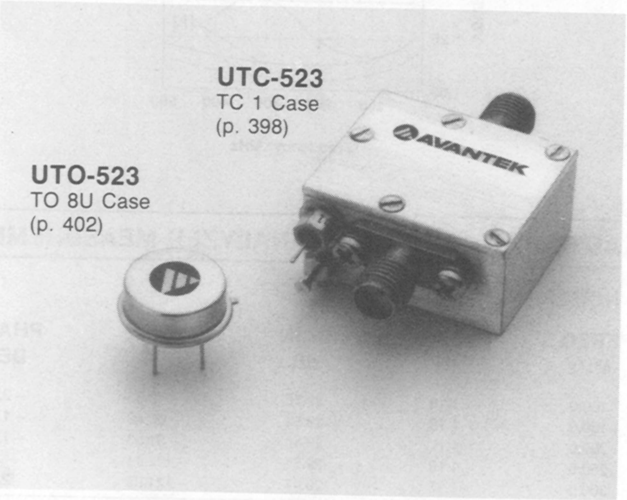
523 Series

Thin Film Cascadable Amplifier
5-500 MHz

AVANTEK

FEATURES

- **High Gain: 25.5 dB**
- **Medium Power Output: +13.5 dBm**


UTC-523
TC 1 Case
(p. 398)

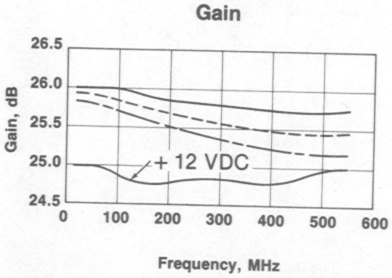
UTO-523
TO 8U Case
(p. 402)

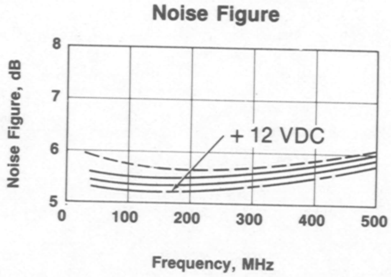
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

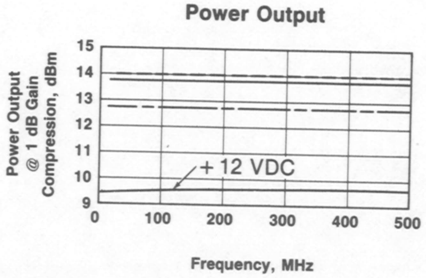
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$-$50°C$	Guaranteed Specifications $T_C = -55°$- $+85°C$	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	25.5	23.0 Min.	23.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	6.0	7.0 Max.	7.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+13.5	+12.0 Min.	+12.0 Min.	dBm
—	Input VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+25.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+36.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+40.0	—	—	dBm
I_D	DC Current	80	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

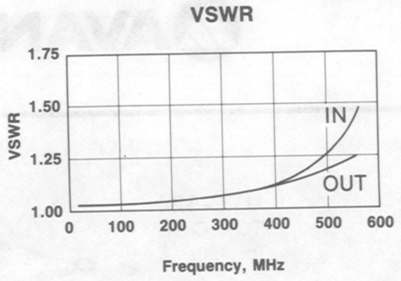
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +115°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+115°C

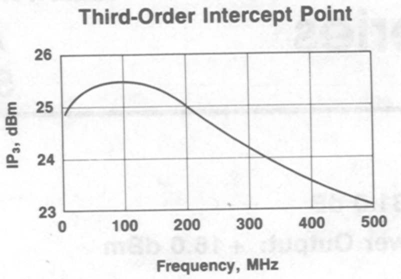
THERMAL CHARACTERISTICS*

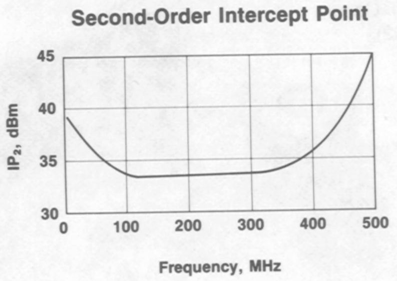
θ_{JC}	155/105°C/W
Active Transistor Power Dissipation	90/321 mW
Junction Temperature Above Case Temperature	14/34°C
MTBF	1,187,895 Hrs.

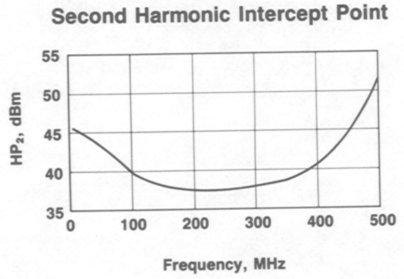
*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams


VSWR


Third-Order Intercept Point


Second-Order Intercept Point


Second Harmonic Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.07	26.02	– 34.45	– 1.52	– .55	—	1.07	42.66
150.0	1.06	25.88	– 52.04	– .72	– .09	1.00	1.06	46.44
200.0	1.02	25.77	– 70.50	– .79	– .50	1.02	1.07	48.04
250.0	1.04	25.37	– 88.59	– .49	– .54	.96	1.09	47.67
300.0	1.06	25.38	– 105.00	1.47	1.08	.94	1.10	44.60
350.0	1.10	25.75	– 122.59	2.27	1.55	1.01	1.09	46.45
400.0	1.15	25.66	– 141.35	1.89	.83	1.04	1.13	41.06
450.0	1.20	25.62	– 160.00	1.64	.24	1.08	1.17	46.12
500.0	1.29	25.76	179.70	– .27	– 2.00	1.08	1.20	42.76
550.0	1.42	25.78	161.03	– .55	—	1.10	1.25	39.86
600.0	1.58	25.72	140.28	– 2.91	—	1.23	1.33	38.52
650.0	1.91	25.52	116.85	—	—	1.31	1.43	42.63
700.0	2.48	25.14	92.97	—	—	1.41	1.51	40.96
LINEARIZATION RANGE:				100.0 TO 600.0	100.0 TO 500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 RATIO	21 ANGLE	12 RATIO	12 ANGLE	22 RATIO	22 ANGLE
100.00	.015	166.5	21.257	– 38.2	.004	7.0	.037	– 23.0
200.00	.012	– 77.5	20.983	– 73.8	.004	8.7	.039	– 42.8
300.00	.052	– 94.2	21.232	– 108.4	.005	– .6	.045	– 67.8
400.00	.104	– 130.3	21.100	– 146.4	.005	– 2.8	.061	– 86.2
500.00	.186	– 176.0	21.733	173.1	.007	– 12.6	.093	– 106.7
600.00	.329	133.5	21.480	130.3	.009	– 30.4	.150	– 129.0
700.00	.564	77.8	19.417	78.7	.010	– 59.2	.225	– 160.5
800.00	.787	27.2	13.897	26.4	.008	– 95.3	.261	165.4
900.00	.891	– 14.8	8.271	– 21.4	.006	– 127.3	.248	138.8
1000.00	.912	– 44.0	4.639	– 56.5	.004	– 153.3	.210	125.0

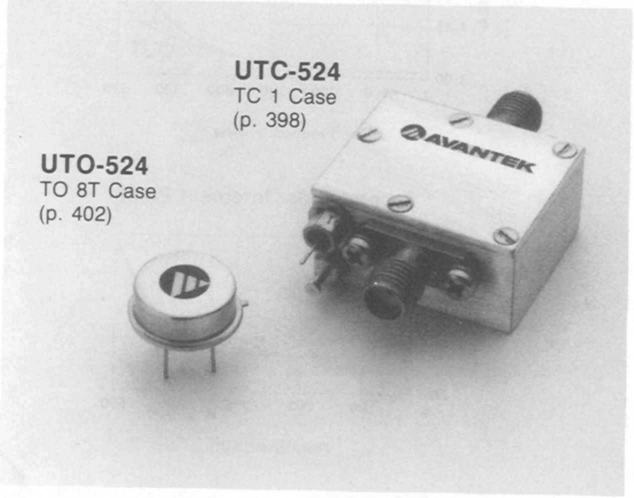
524 Series

Thin Film Cascadable Amplifier 5-500 MHz

AVANTEK

FEATURES

- **High Gain: 31.0 dB**
- **Medium Power Output: +16.0 dBm**



UTC-524
TC 1 Case
(p. 398)

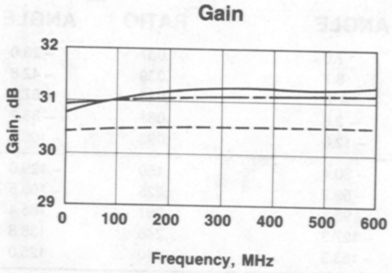
UTO-524
TO 8T Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

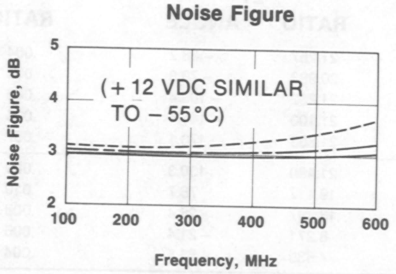
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°-50°C$	Guaranteed Specifications $T_C = -55°- +85°C$	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	31.0	30.0 Min.	30.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	3.0	4.0 Max.	4.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+16.0	+14.0 Min.	+14.0 Min.	dBm
—	Input VSWR	<1.6:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+27.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+34.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+40.0	—	—	dBm
I_D	DC Current	70	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

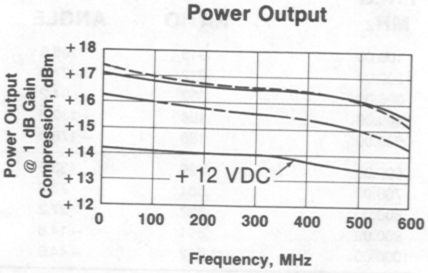
KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—



Gain



Noise Figure



Power Output

MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +100°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+100°C

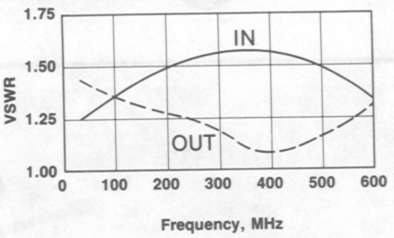
THERMAL CHARACTERISTICS*

θ_{JC}	120/110°C/W
Active Transistor Power Dissipation	131/420 mW
Junction Temperature Above Case Temperature	16/45°C
MTBF	567,008 Hrs.

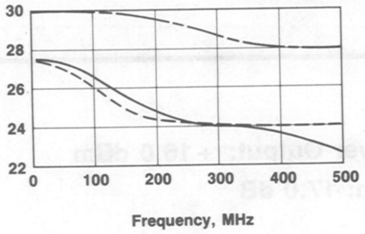
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

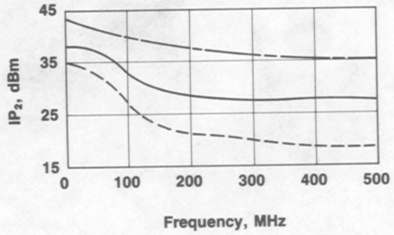
VSWR



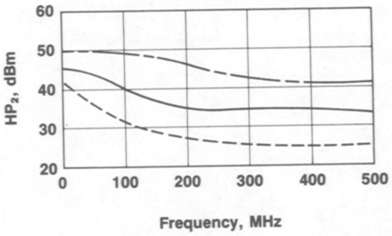
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.25	31.46	– 2.038	.10	.00	1.05	40.57
150.0	1.34	31.51	– 32.57	– .23	.66	1.04	39.54
200.0	1.42	31.44	– 44.01	.19	.65	1.04	40.12
250.0	1.48	31.38	– 56.01	.05	.67	1.04	40.34
300.0	1.52	31.38	– 67.96	– .03	.66	1.03	39.95
350.0	1.54	31.34	– 79.78	.00	.66	1.03	39.95
400.0	1.53	31.35	– 91.84	– .20	.66	1.05	39.79
450.0	1.52	31.39	– 103.59	– .09	.65	1.08	40.15
500.0	1.49	31.37	– 115.14	.21	.65	1.11	40.04
550.0	1.46	31.33	– 126.91	—	.67	1.15	40.03
600.0	1.46	31.27	– 139.17	—	.69	1.20	40.47
650.0	1.46	31.23	– 151.74	—	.72	1.24	40.26
700.0	1.53	31.22	– 164.94	—	.76	1.30	40.74
750.0	1.66	31.13	– 179.01	—	.81	1.34	40.68
800.0	1.86	31.04	– 165.76	—	.86	1.36	40.68
850.0	2.18	30.81	149.93	—	.91	1.38	40.41
900.0	2.58	30.32	133.10	—	.94	1.36	39.58
950.0	3.04	29.59	116.05	—	.90	1.31	39.11
1000.0	3.48	28.52	100.77	—	.79	1.26	38.54

LINEARIZATION RANGE: 100.0 TO 500.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ MHz	11		21		12		22	
	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.116	90.4	31.304	– 20.6	– 41.203	– 2.1	.035	– 11.8
200.00	.179	67.3	31.292	– 43.6	– 39.699	– 4.1	.040	– 55.7
300.00	.209	47.6	31.294	– 67.4	– 39.988	– 14.8	.031	– 109.3
400.00	.209	25.9	31.400	– 91.4	– 40.334	– 25.1	.042	168.3
500.00	.186	– 2.9	31.539	– 115.2	– 40.886	– 29.3	.091	128.7
600.00	.166	– 47.8	31.555	– 140.4	– 41.566	– 33.0	.146	107.4
700.00	.193	– 108.2	31.508	– 168.0	– 42.063	– 37.1	.190	87.6
800.00	.296	– 163.8	31.091	160.4	– 41.981	– 37.6	.203	65.3
900.00	.423	149.7	29.882	127.5	– 40.913	– 38.9	.177	46.8
1000.00	.515	112.6	27.794	98.0	– 39.580	– 50.7	.129	42.4

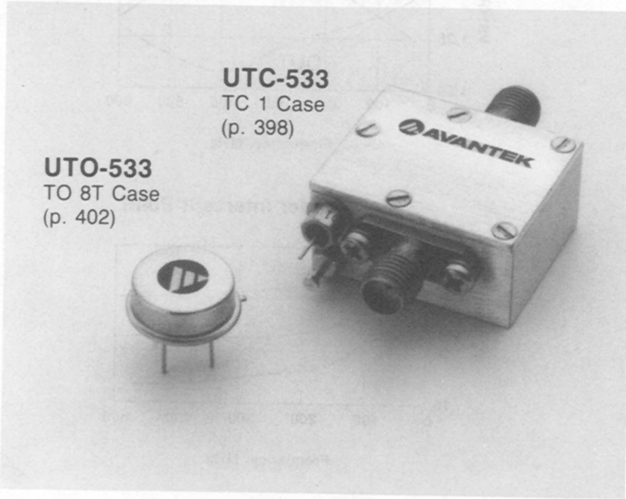
533 Series

Thin Film Cascadable Amplifier 5-500 MHz

AVANTEK

FEATURES

- **Medium Power Output: +16.0 dBm**
- **Medium Gain: 17.0 dB**



UTC-533
TC 1 Case
(p. 398)

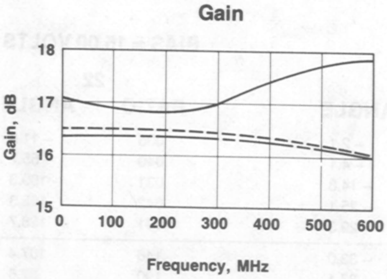
UTO-533
TO 8T Case
(p. 402)

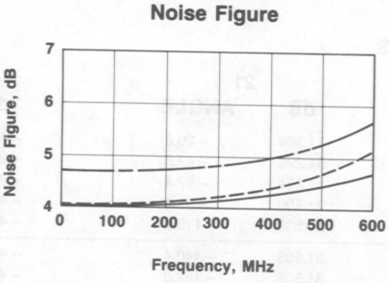
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

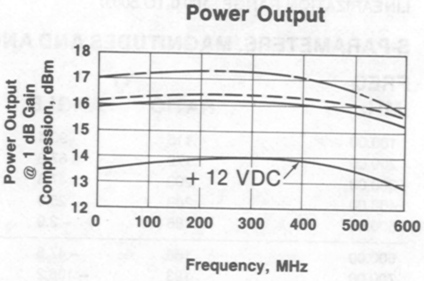
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	5-500	5-500	5-500	MHz
GP	Small Signal Gain	17.0	16.0 Min.	15.0 Min.	dB
—	Gain Flatness	±0.5	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	4.5	5.0 Max.	5.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+16.0	+14.0 Min.	+13.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+30.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+43.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+49.0	—	—	dBm
I_D	DC Current	53	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

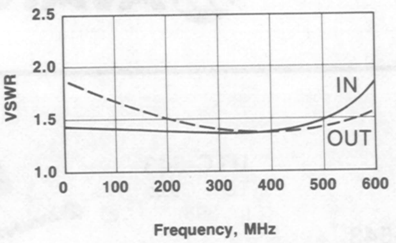
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +100°C

THERMAL CHARACTERISTICS*

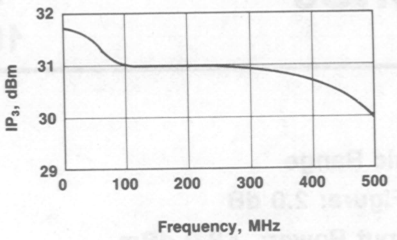
θ_{JC} .... 105°C/W
Active Transistor Power Dissipation .... 475 mW
Junction Temperature Above Case Temperature .... 50°C
MTBF .... 991,658 Hrs.

*For further information, see High Reliability section.

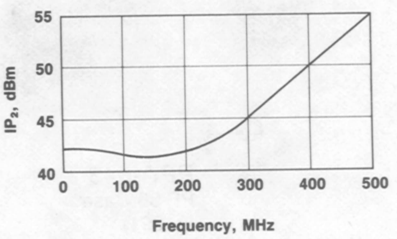
WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



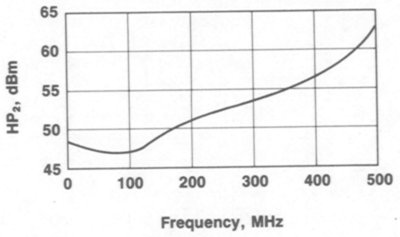
VSWR



Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.117	– 169.9	16.959	155.6	– 22.427	– 13.3	.219	160.5
150.00	.119	– 167.0	16.931	– 143.1	– 22.254	– 18.4	.209	150.8
200.00	.121	– 163.8	16.899	129.9	– 22.473	– 24.5	.204	142.6
250.00	.130	– 159.2	16.971	117.0	– 22.458	– 30.7	.194	135.4
300.00	.145	– 158.1	17.069	104.3	– 22.181	– 37.0	.185	128.5
350.00	.163	– 163.3	17.174	91.3	– 22.501	– 44.6	.179	124.4
400.00	.180	– 173.6	17.320	77.9	– 22.585	– 53.4	.174	121.6
450.00	.187	168.5	17.498	63.5	– 22.464	– 61.7	.176	120.9
500.00	.199	139.1	17.658	47.2	– 22.640	– 70.2	.190	120.2
550.00	.230	97.9	17.838	29.0	– 22.925	– 79.5	.215	117.4
600.00	.318	50.2	17.676	7.2	– 23.363	– 91.6	.248	110.2
650.00	.474	8.8	16.886	– 17.0	– 24.183	– 103.1	.269	99.0
700.00	.629	– 24.8	15.238	– 40.4	– 25.508	– 111.3	.271	87.1
750.00	.737	– 51.3	13.019	– 59.7	– 27.101	– 118.1	.256	77.5
800.00	.809	– 71.3	10.584	– 75.0	– 28.227	– 122.9	.236	71.8
850.00	.851	– 86.2	8.223	– 87.7	– 29.293	– 125.8	.222	68.2
900.00	.874	– 98.3	5.956	– 97.1	– 30.027	– 129.6	.218	65.9
950.00	.892	– 108.0	3.837	– 104.7	– 30.773	– 132.1	.215	64.0
1000.00	.907	– 115.9	1.928	– 111.0	– 31.479	– 135.5	.216	61.8

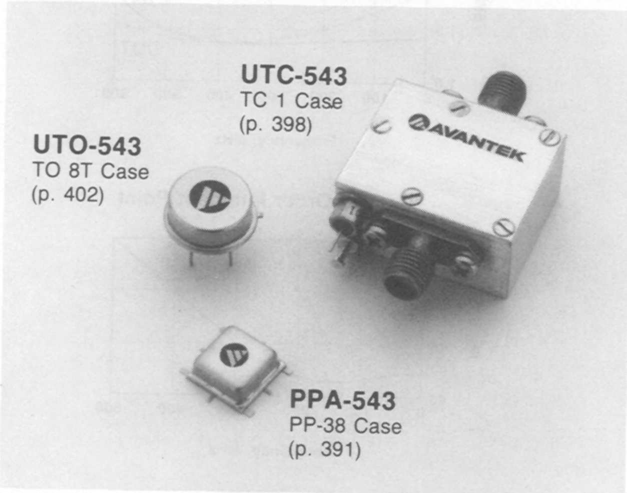
543 Series

Thin Film Cascadable Amplifier 10-500 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **Low Noise Figure: 2.0 dB**
- **Medium Output Power: +8.0 dBm**



ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

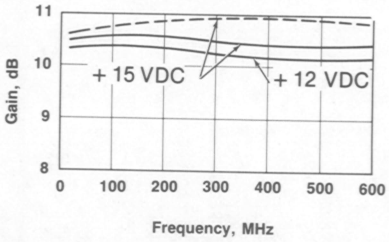
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°-50°C$	$T_C = -55°- +85°C$	Unit
BW	Frequency Range	10-500	10-500	10-500	MHz
GP	Small Signal Gain	10.5	10.0 Min.	9.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	2.0	2.5 Max.	3.0 Max.	dB
$P_{1 dB}$	Power Output @ +1 dB Compression	+8.0	+6.0 Min.	+6.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+22.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+30.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+36.0	—	—	dBm
I_D	DC Current	25	—	—	mA

NOTE 1: Both RF input and RF output pins are at DC ground — no blocking capacitor.

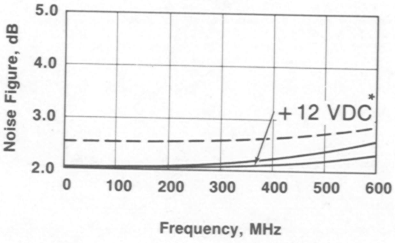
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

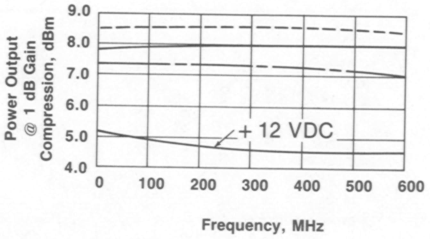
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

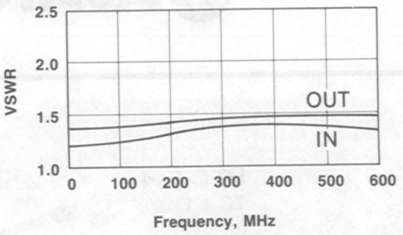
THERMAL CHARACTERISTICS*

θ_{JC} .... 120°C/W
Active Transistor Power Dissipation .... 176 mW
Junction Temperature Above Case Temperature .... 21°C
MTBF .... 1,065,331 Hrs.

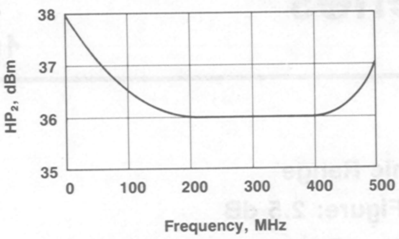
*For further information, see High Reliability section.

WEIGHT: (typical) PPA — 0.5 grams; UTO — 2.1 grams; UTC — 21.5 grams

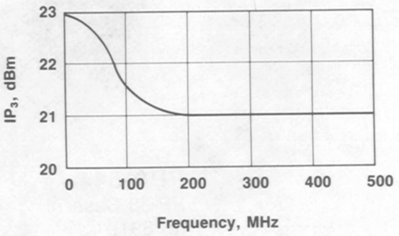
VSWR



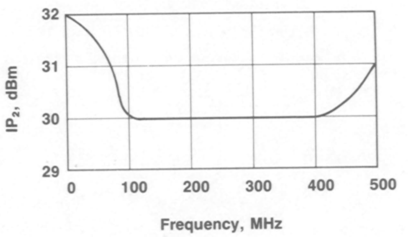
Second Harmonic Intercept Point



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.06	10.81	167.92	1.37	.00	1.15	16.41
150.0	1.11	10.70	159.48	.66	.46	1.21	16.15
200.0	1.16	10..69	151.41	.32	.44	1.27	16.26
250.0	1.22	10.64	143.51	.15	.44	1.33	16.45
300.0	1.25	10.64	135.73	.10	.43	1.39	16.56
350.0	1.29	10.64	128.09	.20	.42	1.42	16.47
400.0	1.31	10.62	120.64	.48	.41	1.45	16.47
450.0	1.32	10.61	113.38	.94	.41	1.46	16.45
500.0	1.32	10.58	105.83	1.12	.42	1.45	16.45
600.0	1.28	10.50	90.55	1.31	.43	1.38	16.38
700.0	1.23	10.29	74.82	1.03	.47	1.25	16.30
800.0	1.22	10.04	57.48	−.83	.46	1.12	16.23
900.0	1.33	9.54	40.71	−2.14	.47	1.20	16.24
1000.0	1.51	8.91	24.20	−3.19	.45	1.46	16.38
1100.0	1.76	8.07	8.33	−3.59	.42	1.80	16.71
1200.0	2.01	7.15	−6.40	−2.87	.39	2.20	17.09
1300.0	2.26	6.20	−19.73	−.72	.35	2.59	17.60

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.028	140.0	10.745	166.8	−16.327	169.3	.066	127.9
150.00	.052	99.1	10.702	158.7	−16.326	160.9	.091	103.5
200.00	.075	85.1	10.607	150.4	−16.398	154.0	.119	86.8
250.00	.098	73.2	10.577	142.2	−16.462	147.3	.141	77.3
300.00	.116	68.0	10.562	134.3	−16.635	140.4	.157	67.2
350.00	.128	61.6	10.579	126.5	−16.542	134.0	.171	59.8
400.00	.133	55.3	10.584	118.9	−16.381	127.6	.179	52.0
450.00	.135	49.6	10.596	111.4	−16.481	122.1	.180	45.2
500.00	.133	46.2	10.547	103.5	−16.410	115.8	.179	38.3
550.00	.126	44.6	10.553	95.9	−16.430	109.7	.166	32.2
600.00	.115	43.7	10.506	87.9	−16.397	103.5	.151	27.2
700.00	.097	53.8	10.317	71.7	−16.316	91.5	.102	23.0
800.00	.097	78.2	10.040	53.9	−16.298	78.3	.052	57.1
900.00	.147	93.7	9.561	36.7	−16.346	65.2	.100	111.9
1000.00	.207	93.7	8.920	19.7	−16.525	53.0	.193	113.2
1100.00	.278	86.8	8.092	3.4	−16.737	39.8	.286	104.1
1200.00	.328	76.7	7.211	−11.7	−17.171	27.7	.371	94.5
1300.00	.378	70.0	6.278	−25.3	−17.517	16.1	.437	84.8

LINEARIZATION RANGE: 100.0 TO 1500.0

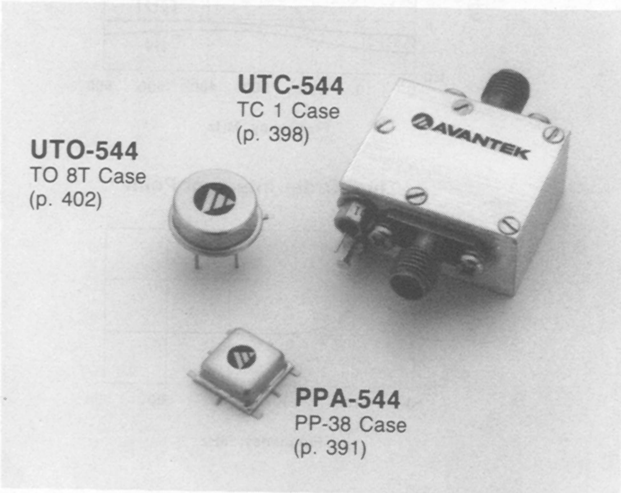
544 Series

Thin Film Cascadable Amplifier
10-500 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **Low Noise Figure: 2.5 dB**
- **Medium Output Power: +13.0 dBm**



UTC-544
TC 1 Case
(p. 398)

UTO-544
TO 8T Case
(p. 402)

PPA-544
PP-38 Case
(p. 391)

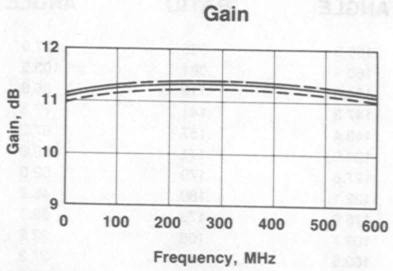
ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

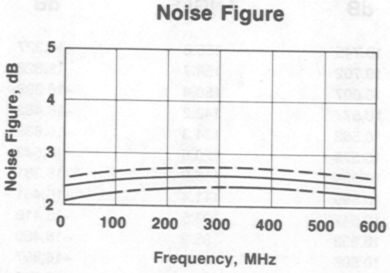
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°, +85°C$	Unit
BW	Frequency Range	10-500	10-500	10-500	MHz
GP	Small Signal Gain	11.0	10.0 Min.	9.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	2.5	3.0 Max.	3.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+13.0	+12.0 Min.	+11.0 Min.	dBm
—	Input VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+28.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+40.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+46.0	—	—	dBm
I_D	DC Current	35	—	—	mA

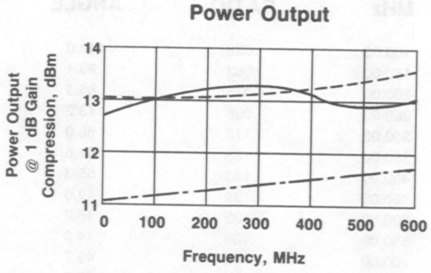
NOTE 1: Both RF input and RF output pins are at DC ground — no blocking capacitor.

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ————
+85°C – – – –
−55°C —·—·—







MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

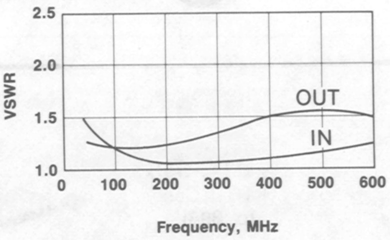
THERMAL CHARACTERISTICS*

θ_{JC}	120°C/W
Active Transistor Power Dissipation	256 mW
Junction Temperature Above Case Temperature	31°C
MTBF	862,436 Hrs.

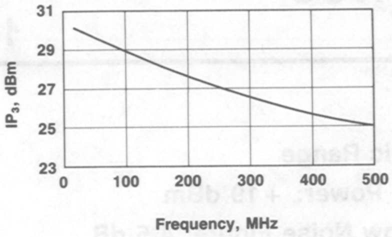
*For further information, see High Reliability section.

WEIGHT: (typical) PPA — 0.5 grams; UTO — 2.1 grams; UTC — 21.5 grams

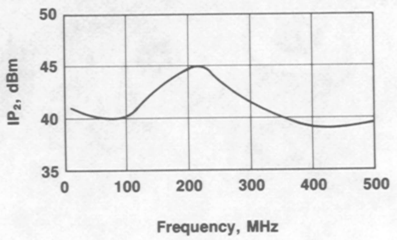
VSWR



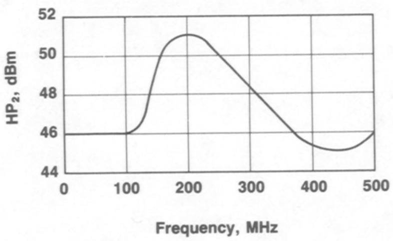
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

BIAS = 15.00 VOLTS

NUMERICAL READINGS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.10	11.12	167.20	.04	.00	1.18	15.90
150.0	1.12	11.02	158.40	–.61	.48	1.22	16.04
200.0	1.14	10.99	149.73	–1.14	.47	1.27	16.23
250.0	1.17	10.93	141.47	–1.26	.46	1.32	16.26
300.0	1.19	10.90	133.27	–1.32	.45	1.37	16.31
350.0	1.20	10.87	125.36	–1.10	.43	1.41	16.35
400.0	1.21	10.84	117.71	–.62	.42	1.44	16.31
450.0	120	10.80	110.24	.04	.42	1.46	16.34
500.0	1.19	10.74	102.57	.51	.42	1.47	16.39
600.0	1.16	10.62	87.22	1.43	.43	1.46	16.38
700.0	1.13	10.43	71.50	2.00	.44	1.42	16.34
800.0	1.18	10.28	55.07	1.85	.49	1.39	16.35
900.0	1.31	9.90	37.33	.38	.48	1.40	16.34
1000.0	1.50	9.48	20.34	–.32	.47	1.50	16.43

LINEARIZATION RANGE: 100.0 TO 1500.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.048	159.9	11.112	166.3	–16.053	169.6	.082	143.7
150.00	.053	124.4	11.047	157.5	–16.251	161.5	.097	121.4
200.00	.064	100.5	10.930	148.7	–16.193	153.2	.119	104.8
250.00	.078	79.2	10.879	140.1	–16.290	147.2	.136	93.9
300.00	.087	65.7	10.850	131.8	–16.454	139.9	.151	84.7
350.00	.092	53.7	10.843	123.7	–16.448	133.8	.166	77.6
400.00	.090	40.2	10.815	115.8	–16.342	127.1	.176	71.3
450.00	.089	24.2	10.799	108.1	–16.299	121.3	.182	65.9
500.00	.084	11.3	10.726	100.1	–16.311	115.3	.185	60.7
600.00	.066	–26.9	10.634	84.4	–16.394	103.4	.183	55.4
700.00	.063	–82.5	10.462	68.1	–16.372	91.5	.172	54.5
800.00	.096	–136.7	10.254	51.4	–16.351	79.1	.166	59.7
900.00	.152	–171.1	9.915	33.1	–16.413	66.8	.177	68.4
1000.00	.214	167.5	9.489	15.7	–16.533	55.0	.206	75.2
1100.00	.169	147.5	8.913	–1.8	–16.714	41.9	.253	77.0
1200.00	.312	132.1	8.318	–18.7	–16.960	29.8	.300	75.4
1300.00	.346	118.1	7.581	–34.8	–17.323	17.3	.345	71.6
1400.00	.360	106.8	6.796	–50.8	–17.746	6.1	.382	67.0
1500.00	.370	96.9	6.015	–66.7	–18.275	–5.8	.416	62.9

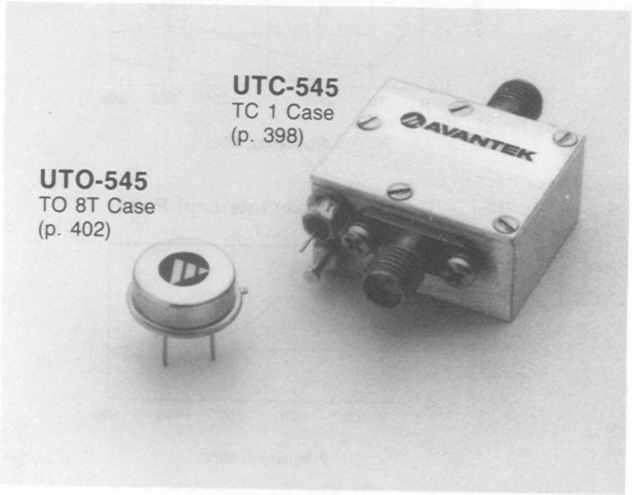
545 Series

Thin Film Cascadable Amplifier
10-500 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **High Output Power: +19 dBm**
- **Relatively Low Noise Figure: 4.5 dB**



UTC-545
TC 1 Case
(p. 398)

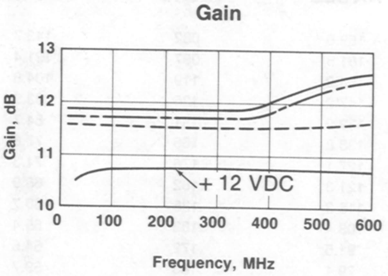
UTO-545
TO 8T Case
(p. 402)

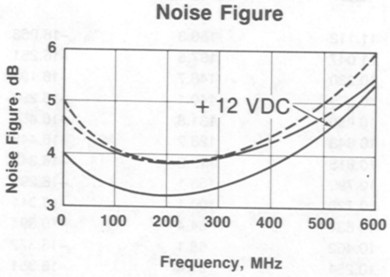
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

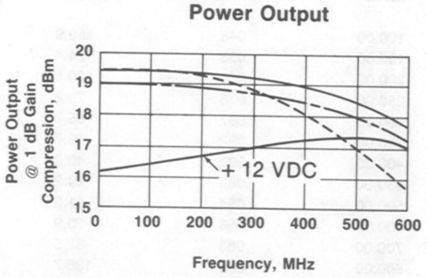
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	
BW	Frequency Range	10-500	10-500	10-500	MHz
GP	Small Signal Gain	11.5	10.0 Min.	10.0 Min.	dB
—	Gain Flatness	±0.3	±0.5 Max.	±0.5 Max.	dB
NF	Noise Figure	4.5	5.0 Max.	5.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+19.0	+17.0 Min.	+16.0 Min.	dBm
—	Input VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	—	
IP_3	Two Tone 3rd Order Intercept Point	+36.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+45.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+51.0	—	—	dBm
I_D	DC Current	60	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +85°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+85°C

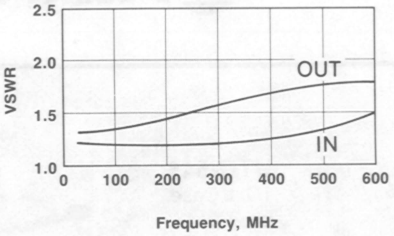
THERMAL CHARACTERISTICS*

θ_{JC}	110°C/W
Active Transistor Power Dissipation	720 mW
Junction Temperature Above Case Temperature	79°C
MTBF	949,186 Hrs.

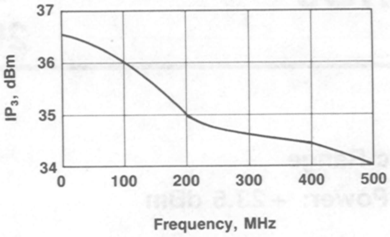
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

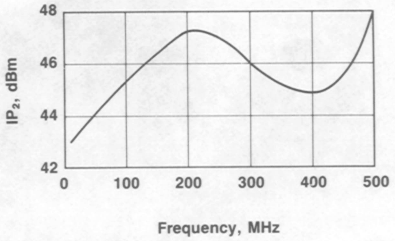
VSWR



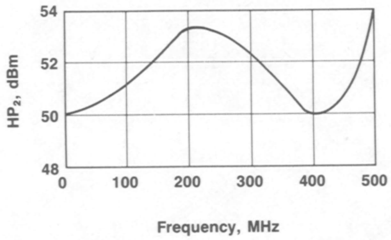
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.18	10.43	166.31	– 5.59	.00	1.26	20.34
150.0	1.17	10.62	158.10	– 4.40	.46	1.32	20.45
200.0	1.16	10.63	149.90	– 3.21	.43	1.39	20.42
250.0	1.13	10.71	142.56	– 1.15	.42	1.46	20.37
300.0	1.10	10.85	134.67	.34	.44	1.53	20.34
350.0	1.06	10.91	126.57	1.64	.42	1.60	20.29
400.0	1.02	11.06	119.49	3.96	.44	1.65	20.17
450.0	1.07	11.19	110.59	4.45	.50	1.68	20.03
500.0	1.16	11.30	101.37	4.62	.52	1.70	19.88
550.0	1.27	11.42	91.92	4.57	.55	1.68	19.75
600.0	1.42	11.51	81.70	3.75	.58	1.62	19.66
650.0	1.62	11.49	71.07	2.51	.59	1.53	19.64
700.0	1.85	11.43	60.46	1.30	.59	1.44	19.68
750.0	2.15	11.25	49.77	.01	.59	1.31	19.78
800.0	2.53	10.98	39.13	– 1.23	.59	1.17	19.94
850.0	2.96	10.58	28.51	– 2.46	.57	1.06	20.19
900.0	3.42	10.10	18.60	– 2.98	.54	1.08	20.50
950.0	3.99	9.55	9.04	– 3.15	.52	1.22	20.83
1000.0	4.56	8.94	– .20	– 3.00	.00	1.36	21.22

LINEARIZATION RANGE: 100.0 TO 1000.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.081	3.3	10.617	167.5	– 20.222	168.9	.120	30.5
200.00	.070	8.5	10.692	155.3	– 20.441	160.8	.168	37.0
300.00	.046	10.2	10.888	142.2	– 20.313	150.4	.214	34.3
400.00	.004	99.7	11.229	128.7	– 20.128	140.0	.246	27.3
500.00	.072	175.8	11.519	114.4	– 19.883	130.0	.254	17.4
600.00	.173	169.9	11.655	98.3	– 19.765	118.7	.233	5.2
700.00	.300	160.9	11.544	80.4	– 19.810	106.1	.170	– 7.0
800.00	.433	149.9	11.027	62.4	– 20.111	93.5	.075	– 11.5
900.00	.546	138.8	10.067	44.5	– 20.668	81.3	.054	106.1
1000.00	.633	129.5	8.811	28.4	– 21.540	70.0	.162	111.1

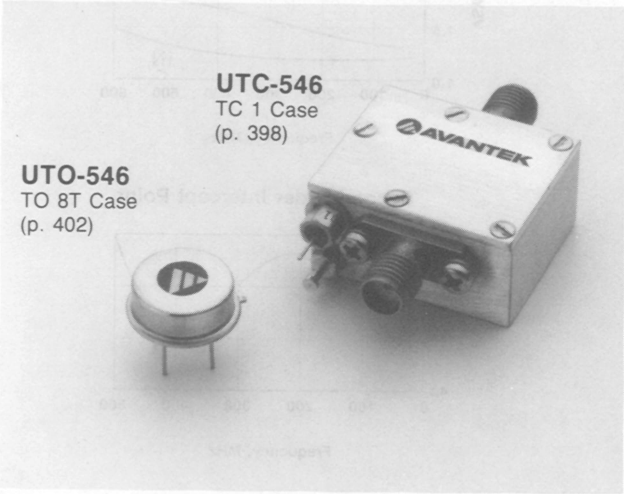
546 Series

Thin Film Cascadable Amplifier 20-500 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **High Output Power: +23.5 dBm**



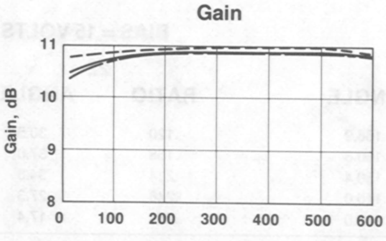
ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

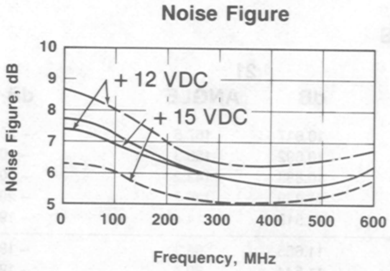
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	10-500	20-500	20-500	MHz
GP	Small Signal Gain	11.5	10.0 Min.	10.0 Min.	dB
—	Gain Flatness	±0.2	±0.5 Max.	±0.5 Max.	dB
NF	Noise Figure	6.0	8.0 Max.	8.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+23.5	+23.0 Min.	+22.0 Min.	dBm
—	Input VSWR	<1.7:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.7:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+38.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+50.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+56.0	—	—	dBm
I_D	DC Current	110	—	—	mA

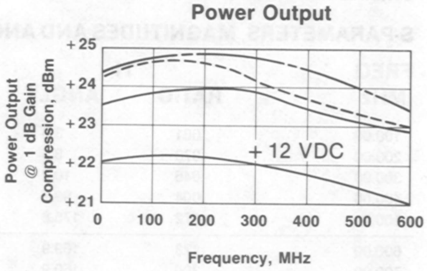
NOTE 1: A portion of any DC voltage applied to the RF input pin will appear at the RF output pin (i.e., a resistive DC path exists between pins). There is no input or output blocking capacitor.

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—


Gain


Noise Figure


Power Output

MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +17 dBm
Operating Case Temperature .... −55°C to +85°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +85°C

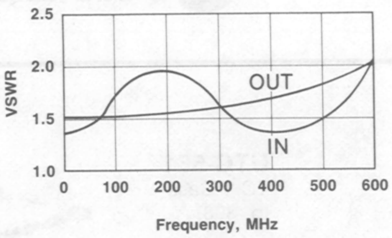
THERMAL CHARACTERISTICS*

θ_{JC} .... 80°C/W
Active Transistor Power Dissipation .... 840 mW
Junction Temperature Above Case Temperature .... 67°C
MTBF .... 806,452 Hrs.

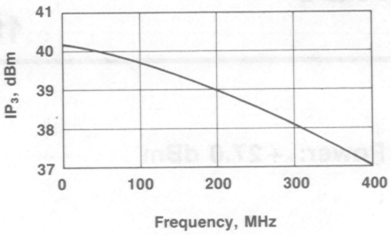
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

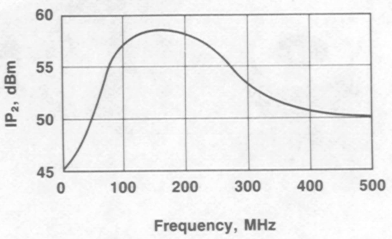
VSWR



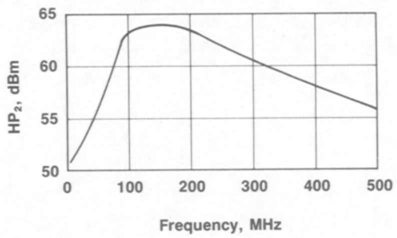
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.70	10.80	153.07	– .41	.00	1.48	20.21
150.0	1.69	10.75	138.16	– .34	.83	1.56	20.25
200.0	1.72	10.75	123.16	– .39	.81	1.64	20.14
250.0	1.72	10.77	108.84	.26	.80	1.71	19.93
300.0	1.73	10.78	94.21	.60	.82	1.77	19.71
350.0	1.71	10.74	79.48	.84	.82	1.82	19.42
400.0	1.70	10.70	64.55	.88	.85	1.82	19.26
450.0	1.70	10.59	48.75	.05	.90	1.79	19.06
500.0	1.74	10.46	32.23	– 1.49	.95	1.77	18.89
550.0	1.86	10.20	14.70	—	1.00	1.72	18.76
600.0	2.10	9.81	– 3.69	—	1.05	1.63	18.85
650.0	2.51	9.26	– 22.99	—	1.09	1.52	19.01
700.0	3.15	8.43	– 42.99	—	1.09	1.38	19.51
750.0	4.09	7.38	– 62.09	—	1.07	1.19	20.14
800.0	5.46	5.99	– 81.67	—	1.05	1.12	21.13
850.0	7.35	4.30	– 100.03	—	.99	1.31	22.42
900.0	9.75	2.35	– 117.21	—	.95	1.62	24.04
950.0	12.78	.25	– 134.39	—	.86	2.00	25.66
1000.0	16.33	– 1.94	– 148.23	—	.73	2.44	27.55

LINEARIZATION RANGE: 100.0 TO 500.0

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.261	– 170.5	10.828	153.5	– 19.567	154.8	.166	– 174.6
200.00	.250	– 167.7	10.794	124.1	– 19.406	123.1	.212	160.8
300.00	.241	– 161.0	10.804	95.3	– 19.034	93.6	.254	125.0
400.00	.239	– 148.7	10.665	65.6	– 18.778	64.6	.282	82.0
500.00	.278	– 132.3	10.310	34.1	– 18.614	34.4	.298	32.3
600.00	.378	– 122.4	9.543	– .5	– 18.744	2.5	.299	– 21.0
700.00	.524	– 122.3	8.190	– 37.8	– 19.444	– 31.8	.242	– 73.6
800.00	.684	– 129.3	5.958	– 75.1	– 20.911	– 66.0	.086	– 131.5
900.00	.811	– 139.5	2.546	– 110.5	– 23.611	– 97.7	.146	30.6
1000.00	.889	– 149.2	– 1.652	– 142.0	– 26.836	– 124.7	.355	– 9.0

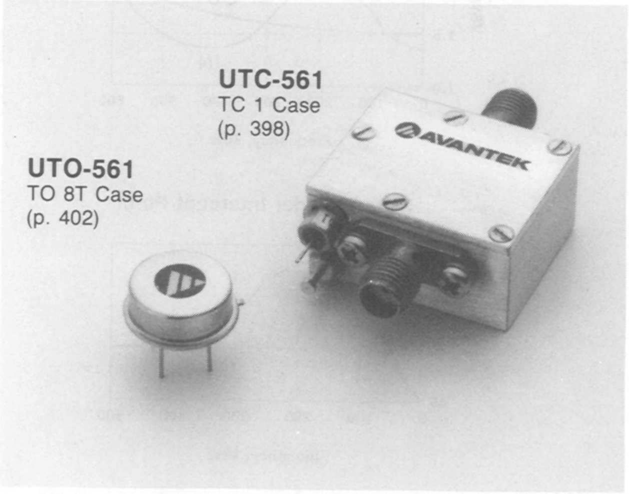
561 Series

Thin Film Cascadable Amplifier 10-500 MHz

AVANTEK

FEATURES

- **High Output Power: +27.0 dBm**


UTC-561
TC 1 Case
(p. 398)

UTO-561
TO 8T Case
(p. 402)

ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

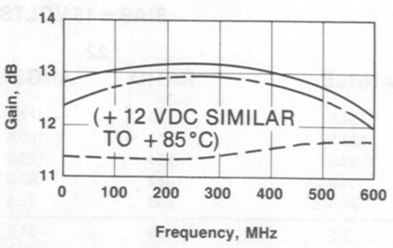
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	10-500	10-500	10-500	MHz
GP	Small Signal Gain	13.0	11.0 Min.	10.0 Min.	dB
—	Gain Flatness	±0.3	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	6.5	9.0 Max.	9.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+27.0	+26.0 Min.	+25.5 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.3:1	2.0:1 Max.	2:0.1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+39.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+51.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+57.0	—	—	dBm
I_D	DC Current	190	—	—	mA

NOTE: RF input pin is at DC ground — no input block capacitor.

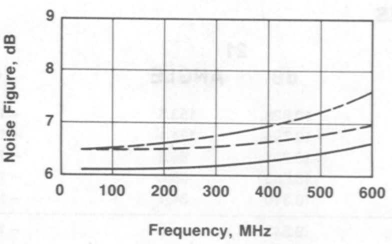
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

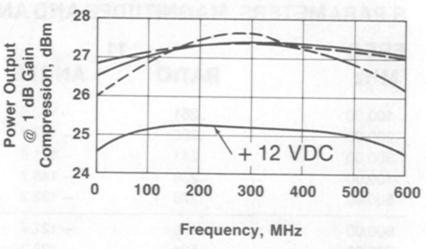
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage .... +16 Volts
Continuous RF Input Power .... +18 dBm
Operating Case Temperature .... −55°C to +85°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +85°C

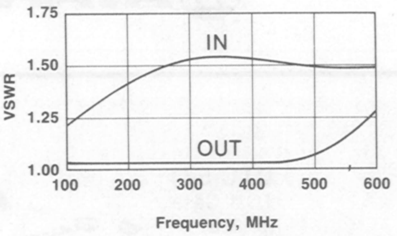
THERMAL CHARACTERISTICS*

θ_{JC} .... 35°C/W
Active Transistor Power Dissipation .... 1900 mW
Junction Temperature Above Case Temperature .... 66°C
MTBF .... 857,783 Hrs.

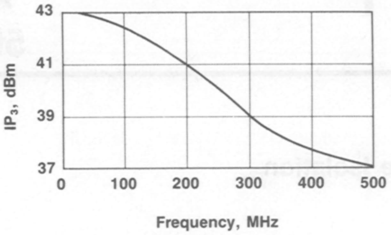
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

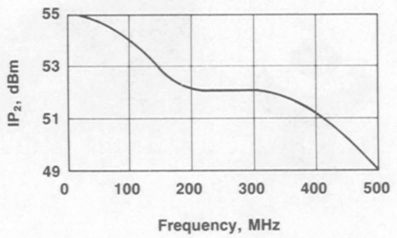
VSWR



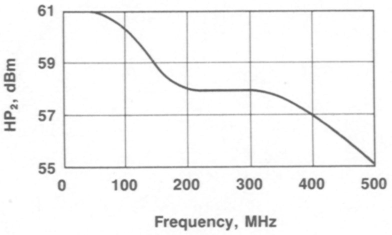
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.31	14.26	156.15	– 1.77	.00	1.31	21.15
150.0	1.37	14.44	142.21	– 1.49	.73	1.28	21.02
200.0	1.44	14.50	129.84	.34	.70	1.25	20.82
250.0	1.51	14.45	116.92	1.65	.75	1.21	20.60
300.0	1.57	14.45	102.98	1.92	.79	1.16	20.33
350.0	1.61	14.43	88.60	1.76	.82	1.10	20.01
400.0	1.61	14.32	73.57	.95	.85	1.06	19.65
450.0	1.54	14.14	57.83	– .54	.90	1.10	19.30
500.0	1.41	13.90	41.35	– 2.81	.92	1.19	18.90
550.0	1.27	13.60	24.63	—	.95	1.34	18.47
600.0	1.16	13.16	7.01	—	1.00	1.55	18.09
650.0	1.33	12.64	– 11.62	—	1.03	1.84	17.90
700.0	1.73	11.80	– 30.17	—	1.07	2.26	17.93
750.0	2.42	10.57	– 50.12	—	1.13	2.87	18.36
800.0	3.55	8.93	– 70.82	—	1.16	3.48	19.42
850.0	5.17	6.63	– 91.98	—	1.11	3.84	21.20
900.0	7.15	3.64	– 110.84	—	1.01	3.88	23.75
950.0	8.82	.07	– 128.38	—	.84	3.59	26.85
1000.0	9.44	– 4.20	– 141.06	—	.00	3.20	30.85

LINEARIZATION RANGE: 100.0 TO 500.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.136	129.5	12.878	157.7	– 20.685	– 4.5	.076	154.9
150.00	.159	105.8	12.832	144.4	– 20.716	– 8.0	.083	160.0
200.00	.177	87.6	12.815	132.8	– 20.703	– 12.3	.092	159.2
250.00	.190	74.1	12.726	121.5	– 20.721	– 15.8	.098	153.6
300.00	.196	63.4	12.692	109.6	– 20.691	– 18.8	.100	149.2
350.00	.194	55.1	12.719	97.6	– 20.639	– 22.6	.095	144.3
400.00	.184	50.0	12.706	84.3	– 20.528	– 26.0	.083	140.6
450.00	.170	49.3	12.601	71.1	– 20.391	– 29.8	.065	140.9
500.00	.163	53.1	12.451	57.8	– 20.247	– 32.6	.045	150.6
550.00	.168	59.6	12.214	43.6	– 20.018	– 37.0	.031	– 176.4
600.00	.185	64.5	11.903	29.6	– 19.715	– 41.6	.042	– 132.0
650.00	.208	66.5	11.503	15.4	– 19.446	– 45.8	.068	– 114.0
700.00	.227	66.9	11.121	2.0	– 19.231	– 51.5	.101	– 106.0
800.00	.237	67.2	10.077	– 24.4	– 18.634	– 65.8	.198	– 100.1
900.00	.238	82.1	9.117	– 54.7	– 18.163	– 85.2	.360	– 108.4
1000.00	.381	99.9	7.407	– 91.1	– 18.489	– 113.8	.554	– 132.2

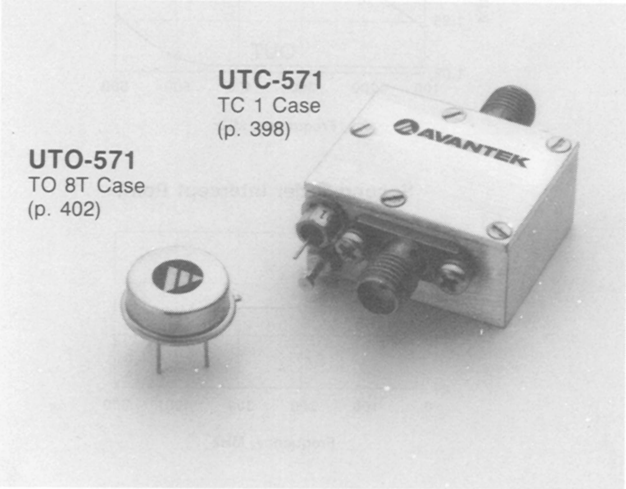
UTO-571

Reverse Isolation Amplifiers
50-500 MHz

AVANTEK

FEATURES

- **High Reverse Isolation**
- **Wideband**
- **Low VSWR**



UTC-571
TC 1 Case
(p. 398)

UTO-571
TO 8T Case
(p. 402)

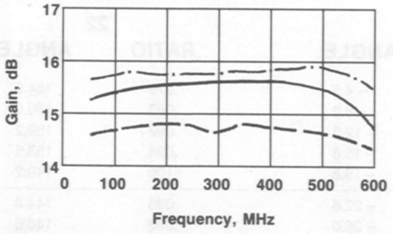
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	Guaranteed Specifications $T_C = -55°, +85°C$	Unit
BW	Frequency Range	50-500	50-500	50-500	MHz
GP	Small Signal Gain	15.5	14.5 Min.	14.0 Min.	dB
—	Gain Flatness	±0.2	±0.5 Max.	±0.5 Max.	dB
NF	Noise Figure	3.1	4.0 Max.	4.5 Max.	dB
—	Reverse Isolation	50	45	45	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+11.5	+10.0 Min.	+10.0 Min.	dBm
—	Input VSWR	1.4:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+27.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+36.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+42.0	—	—	dBm
I_D	DC Current	32	—	—	mA

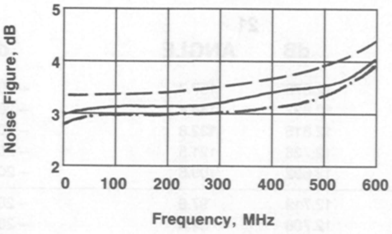
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:	
+25°C	———————
+85°C	— — — —
−55°C	—·—·—·—

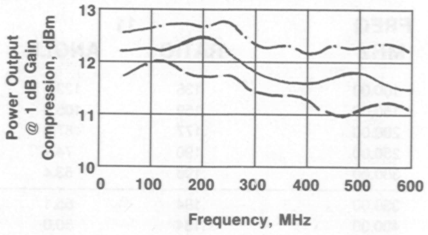
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +115°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +115°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 190°C/W
Active Transistor Power Dissipation .... 150/180 mW
Junction Temperature Above Case Temperature .... 29/35°C

*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.10	15.2	133.7	–.85	–	1.13	58.6
150.0	1.14	15.3	107.2	–.68	1.46	1.09	54.8
200.0	1.18	15.3	81.4	.19	1.45	1.06	52.5
250.0	1.21	15.3	55.1	.55	1.47	1.05	51.3
300.0	1.23	15.3	28.6	.72	1.47	1.06	50.4
350.0	1.23	15.3	2.3	1.09	1.49	1.09	49.7
400.0	1.23	15.3	–24.7	.76	1.51	1.13	49.5
450.0	1.26	15.3	–52.1	.03	1.55	1.18	49.4
500.0	1.36	15.3	–80.6	–1.80	1.58	1.24	49.6

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
GHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.049	–104.0	15.5	142.9	–58.6	53.6	.060	48.2
200.00	.087	–115.3	15.4	97.3	–53.1	35.5	.030	–48.3
300.00	.108	–123.2	15.3	51.7	–50.3	13.2	.040	–139.4
400.00	.112	–119.5	15.3	4.9	–48.9	–9.3	.069	160.1
500.00	.154	–101.0	15.4	–45.5	–48.7	–31.9	.116	112.0
600.00	.313	–102.6	15.0	–101.7	–49.9	–44.0	.171	65.0
700.00	.537	–124.4	13.3	–162.1	–51.0	–25.6	.217	15.3
800.00	.722	–150.7	9.8	142.9	–50.8	–53.7	.228	–25.6
900.00	.840	–175.5	6.0	93.2	–49.9	–89.0	.241	–53.9
1000.00	.885	163.2	1.7	49.5	–49.9	–110.6	.269	–80.3
1100.00	.900	144.5	2.5	10.0	–50.5	–121.8	.302	–106.3
1200.00	.901	128.1	–6.6	–26.5	–51.6	–129.0	.335	–132.2
1300.00	.902	113.9	–10.5	–59.1	–53.4	–138.7	.368	–156.7
1400.00	.893	100.4	–14.3	–90.2	–55.8	–148.2	.396	178.7
1500.00	894	87.2	–17.9	–119.7	–55.8	–158.8	.422	155.5

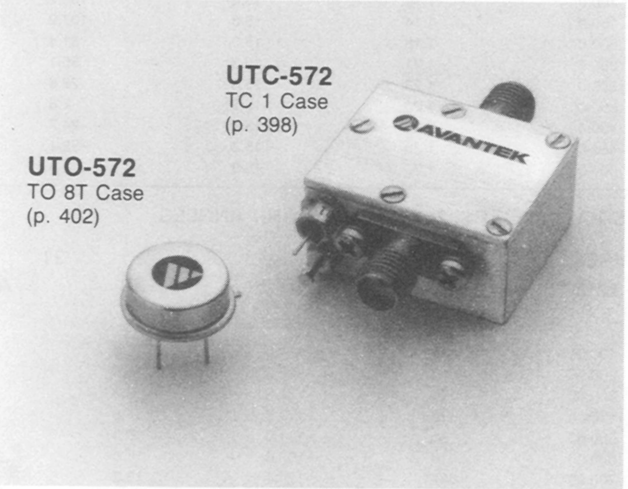
UTO-572

Reverse Isolation Amplifiers 50-500 MHz

AVANTEK

FEATURES

- **High Reverse Isolation**
- **Wideband**
- **Low VSWR**


UTC-572
TC 1 Case
(p. 398)

UTO-572
TO 8T Case
(p. 402)

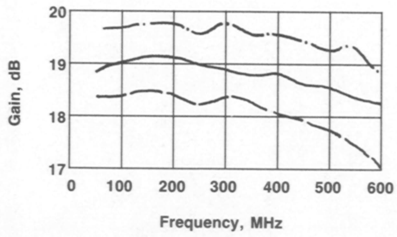
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	Guaranteed Specifications $T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	50-500	50-500	50-500	MHz
GP	Small Signal Gain	18.5	18.0 Min.	17.0 Min.	dB
—	Gain Flatness	±0.3	±0.5 Max.	±1.0 Max.	dB
NF	Noise Figure	3.0	3.5 Max.	3.7 Max.	dB
—	Reverse Isolation	50	45	45	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+12.0	+11.0 Min.	+10.0 Min.	dBm
—	Input VSWR	1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+24.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+34.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+42.0	—	—	dBm
I_D	DC Current	32	—	—	mA

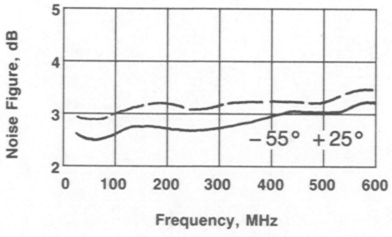
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

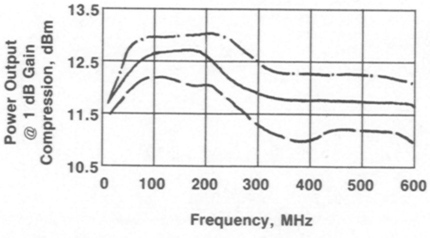
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +115°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +115°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 190°C/W
Active Transistor Power Dissipation .... 150/180 mW
Junction Temperature Above Case Temperature .... 29/35°C

*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.15	19.1	132.7	–.30	–	1.10	58.6
150.0	1.18	19.1	105.8	–.45	1.48	1.06	55.5
200.0	1.21	19.1	79.6	.10	1.47	1.08	53.0
250.0	1.23	19.0	52.9	.14	1.48	1.12	52.3
300.0	1.25	18.9	26.2	.19	1.47	1.17	51.3
350.0	1.25	18.8	–.1	.64	1.47	1.22	50.4
400.0	1.24	18.8	–26.7	.68	1.50	1.29	50.2
450.0	1.24	18.7	–54.0	.23	1.54	1.37	50.0
500.0	1.29	18.6	–82.2	–1.22	1.57	1.45	49.8

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
GHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.077	–62.6	19.4	141.9	–58.3	51.3	.044	31.3
200.00	.101	–109.4	19.3	95.6	–53.9	35.7	.047	–99.7
300.00	.112	–150.2	19.0	49.5	–51.0	12.0	.089	–159.3
400.00	.100	–157.4	18.9	3.0	–49.7	–11.8	.136	155.1
500.00	.109	72.9	18.8	–46.4	–49.4	–40.1	.191	113.4
600.00	.235	–4.9	18.3	–100.8	–49.6	–75.8	.254	70.4
700.00	.455	–58.6	16.6	–158.6	–48.7	–73.8	.282	25.3
800.00	.662	–103.2	13.5	148.1	–47.2	–23.9	.263	–10.4
900.00	.811	–140.0	10.2	98.4	–46.3	–67.4	.269	–33.3
1000.00	.870	–171.7	6.2	53.8	–46.4	–96.6	.309	–56.7
1100.00	.892	162.7	2.3	13.2	–47.0	–113.2	.351	–82.3
1200.00	.891	140.4	–1.2	–23.4	–48.4	–123.8	.389	–108.5
1300.00	.893	120.8	–4.9	–56.9	–50.5	–135.8	.423	–133.6
1400.00	.883	102.3	–8.4	–89.3	–53.9	–147.4	.450	–158.3
1500.00	.883	84.5	–11.6	–119.7	–57.1	–160.2	.479	178.7

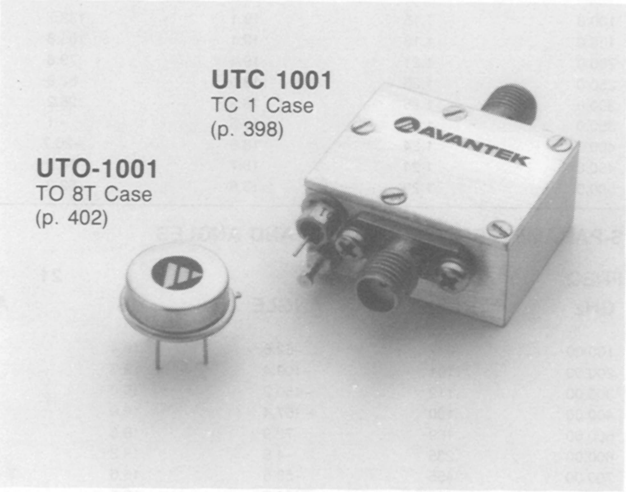
1001 Series

Thin Film Cascadable Amplifier
5-1000 MHz

AVANTEK

FEATURES

- **15.0 dB Gain Stage**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

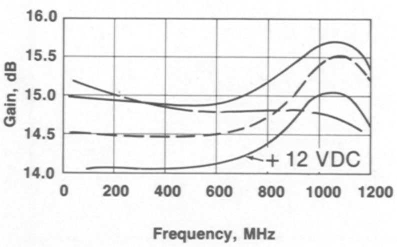
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	T_C = −55°- +85°C	Unit
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	15.0	14.0 Min.	13.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.5	5.0 Max.	5.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+1.0	−2.0 Min.	−3.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+11.0	—	—	dBm
—	One Tone	+53.0	—	—	dBm
I_D	DC Current	10	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

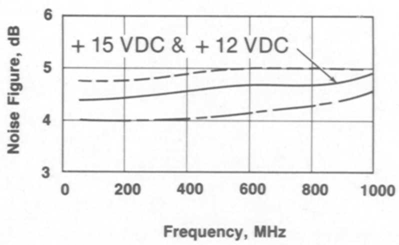
KEY:

+25°C	————
+85°C	— — — —
−55°C	—·—·—

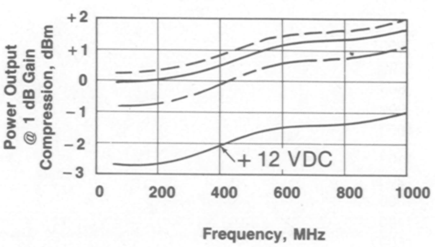
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

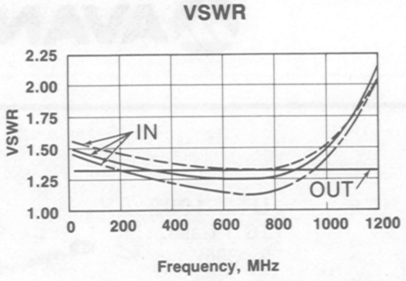
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 155°C/W
Active Transistor Power Dissipation .... 67 mW
Junction Temperature Above Case Temperature .... 10°C
MTBF .... 962,932 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	FLAT dB	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.24	15.77	157.94	−3.57	−2.35	−.22	—	1.23	20.46
150.0	1.24	15.65	148.39	−2.08	−1.06	−.10	.55	1.25	20.47
200.0	1.22	15.55	138.08	−1.36	−.53	−.01	.60	1.24	20.55
250.0	1.24	15.53	126.62	−1.77	−1.15	.00	.60	1.24	20.44
300.0	1.25	15.57	116.62	−.73	−.30	−.02	.56	1.26	20.23
350.0	1.25	15.41	106.42	.10	.33	.12	.60	1.25	20.30
400.0	1.25	15.41	95.06	−.21	−.18	.12	.59	1.26	20.30
450.0	1.25	15.47	85.15	.91	.74	.06	.56	1.24	20.20
500.0	1.25	15.41	74.99	1.80	1.43	.12	.58	1.25	20.13
550.0	1.23	15.44	64.36	2.20	1.64	.10	.59	1.26	20.18
600.0	1.20	15.42	53.62	2.51	1.75	.11	.59	1.25	20.23
650.0	1.20	15.36	43.04	2.98	2.02	.17	.62	1.24	20.23
700.0	1.18	15.52	31.25	2.22	1.07	.01	.60	1.23	20.22
750.0	1.15	15.58	21.59	3.60	2.25	−.04	.58	1.26	19.98
800.0	1.09	15.54	10.53	3.58	2.03	.00	.66	1.25	20.35
850.0	1.09	15.61	−2.21	1.88	.12	−.06	.67	1.24	20.28
900.0	1.15	15.67	−13.77	1.36	−.58	−.12	.67	1.22	20.38
950.0	1.25	15.63	−26.34	−.17	−2.32	−.08	.72	1.23	20.13
1000.0	1.38	15.69	−39.78	−2.57	−4.92	−.15	.73	1.20	20.14
1050.0	1.56	15.62	−52.70	−4.46	—	—	.71	1.19	20.85
1100.0	1.05	15.42	−65.49	−6.21	—	—	.76	1.19	20.35
1150.0	2.26	15.28	−80.08	—	—	—	.82	1.20	21.04
1200.0	2.75	14.79	−94.92	—	—	—	.85	1.25	21.56
LINEARIZATION RANGE:				100.0 TO 1100.0	100.0 TO 1000.0	100.0 TO 1000.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 RATIO	21 ANGLE	12 RATIO	12 ANGLE	22 RATIO	22 ANGLE
100.00	.036	−8.9	5.741	155.9	.102	−7.2	.016	89.7
200.00	.052	−23.3	5.651	136.6	.102	−16.3	.031	63.5
300.00	.079	−36.4	5.659	114.5	.102	−25.6	.038	43.2
400.00	.110	−51.7	5.587	92.5	.099	−34.8	.037	17.9
500.00	.146	−68.0	5.572	71.2	.100	−45.6	.029	−19.9
600.00	.177	−85.3	5.548	50.1	.099	−55.6	.027	−89.8
700.00	.198	−101.8	5.632	27.5	.097	−65.1	.048	−151.0
800.00	.206	−121.8	5.557	6.3	.095	−76.2	.081	177.8
900.00	.187	−147.0	5.701	−18.8	.094	−88.7	.114	149.6
1000.00	.139	172.7	5.854	−44.1	.095	−100.7	.133	125.6
1100.00	.146	87.9	5.882	−72.5	.092	−118.0	.122	95.6
1200.00	.320	24.2	5.593	−105.3	.084	−138.4	.052	59.9
1300.00	.558	−16.2	4.894	−141.6	.069	−161.7	.074	−130.1
1400.00	.744	−47.1	3.735	−174.0	.048	176.6	.212	−166.6
1500.00	.839	−71.6	2.625	157.7	.029	158.6	.325	166.4

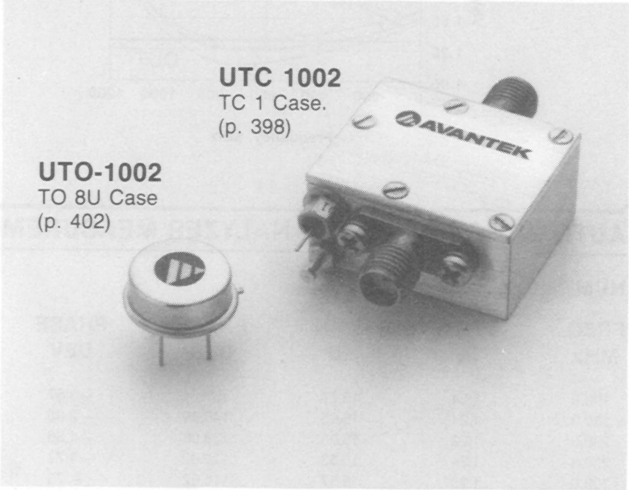
1002 Series

Thin Film Cascadable Amplifier
5-1000 MHz

AVANTEK

FEATURES

- **14.5 dB Gain Stage**
- **+8.5 dBm Output Power**


UTC 1002
TC 1 Case.
(p. 398)

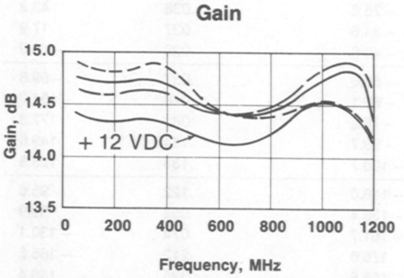
UTO-1002
TO 8U Case
(p. 402)

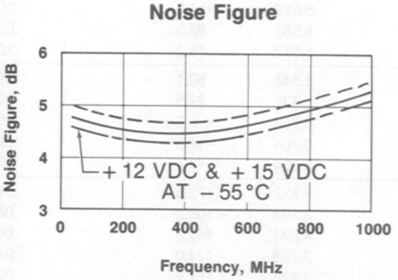
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

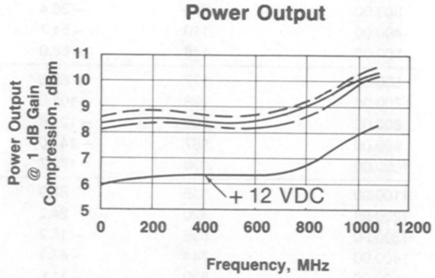
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	14.5	14.0 Min.	13.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	5.0	6.5 Max.	7.0 Max.	dB
$P_{1\text{ dB}}$	Power Output @ + 1 dB Compression	+8.5	+7.0 Min.	+7.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+21.0	—	—	dBm
I_D	DC Current	23	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

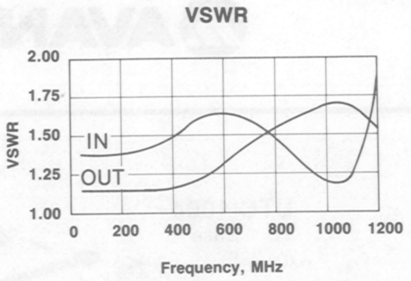
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 155°C/W
Active Transistor Power Dissipation .... 120 mW
Junction Temperature Above Case Temperature .... 19°C
MTBF .... 910,448 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.36	14.85	156.93	– 2.24	– .77	—	1.14	20.63
150.0	1.37	14.72	145.59	– 2.15	– .92	.63	1.13	20.69
200.0	1.40	14.66	134.27	– 2.05	– 1.06	.63	1.14	20.69
250.0	1.43	14.67	122.98	– 1.92	– 1.16	.62	1.15	20.70
300.0	1.45	14.70	111.95	– 1.53	– 1.02	.60	1.16	20.75
350.0	1.49	14.68	101.24	– .82	– .54	.59	1.18	20.76
400.0	1.54	14.65	90.56	– .08	– .04	.59	1.20	20.76
450.0	1.57	14.56	80.05	.82	.63	.59	1.23	20.81
500.0	1.60	14.53	69.29	1.48	1.05	.60	1.25	20.81
550.0	1.63	14.49	58.39	2.01	1.34	.60	1.28	20.84
600.0	1.65	14.44	47.72	2.77	1.86	.60	1.32	20.83
650.0	1.67	14.43	36.75	3.22	2.08	.61	1.37	20.82
700.0	1.66	14.40	25.68	3.58	2.20	.63	1.40	20.79
750.0	1.63	14.40	14.22	3.54	1.92	.64	1.45	20.73
800.0	1.59	14.42	2.58	3.31	1.46	.65	1.52	20.68
850.0	1.52	14.49	– 9.35	2.81	.71	.68	1.57	20.60
900.0	1.43	14.52	– 21.84	1.74	– .58	.71	1.62	20.51
950.0	1.31	14.62	– 34.85	.16	– 2.40	.74	1.68	20.47
1000.0	1.18	14.69	– 48.37	– 1.93	– 4.74	.77	1.72	20.40
1050.0	1.08	14.73	– 62.42	– 4.57	—	.81	1.73	20.41
1100.0	1.24	14.70	– 77.41	– 8.13	—	.86	1.71	20.47
1150.0	1.54	14.50	– 93.33	—	—	.93	1.65	20.66
1200.0	2.00	14.17	– 110.74	—	—	.97	1.55	21.05
1250.0	2.70	13.68	– 128.23	—	—	.95	1.41	21.75
LINEARIZATION RANGE:				100.0 TO 100.0	100.0 TO 1000.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11		21		12		22	
	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
100.00	.048	.8	5.296	156.3	.100	– 6.8	.031	174.6
200.00	.070	– 10.2	5.237	137.1	.100	– 15.3	.034	167.6
300.00	.102	– 25.1	5.290	115.0	.101	– 24.5	.042	163.5
400.00	.136	– 41.6	5.277	93.1	.100	– 33.2	.056	163.0
500.00	.175	– 60.1	5.298	72.2	.103	– 43.8	.081	159.5
600.00	.206	– 79.0	5.350	50.0	.104	– 53.1	.114	154.0
700.00	.224	– 96.4	5.506	27.1	.105	– 63.2	.161	140.2
800.00	.221	– 117.4	5.501	5.6	.106	– 75.5	.215	125.0
900.00	.185	– 143.6	5.720	– 20.6	.110	– 89.7	.270	105.1
1000.00	.108	168.1	5.989	– 47.4	.115	– 105.0	.319	79.9
1100.00	.158	54.6	6.059	– 78.0	.116	– 127.1	.351	44.8
1200.00	.405	.8	5.671	– 113.9	.104	– 153.7	.324	– 2.1
1300.00	.658	– 36.6	4.703	– 152.0	.081	176.4	.291	– 65.7
1400.00	.818	– 64.4	3.395	175.5	.053	149.7	.314	– 125.3
1500.00	.885	– 86.9	2.317	148.4	.030	126.0	.383	– 170.0

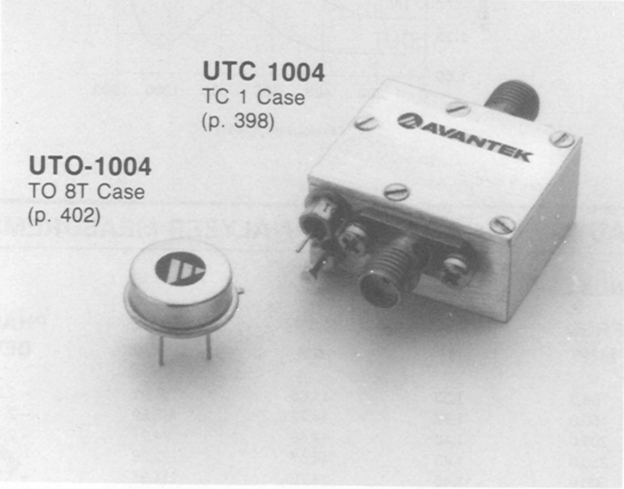
1004 Series

Thin Film Cascadable Amplifier
10-1000 MHz

AVANTEK

FEATURES

- +22.0 Output Power



UTC 1004
TC 1 Case
(p. 398)

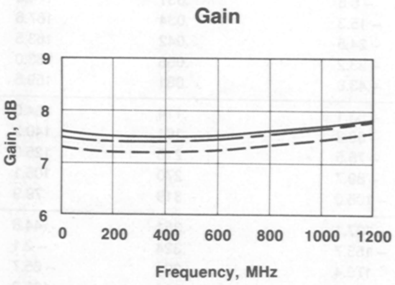
UTO-1004
TO 8T Case
(p. 402)

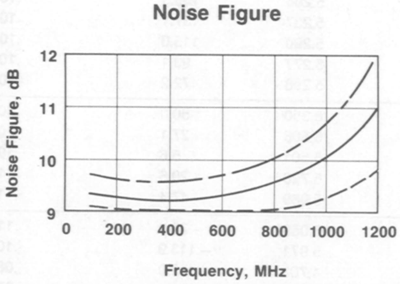
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

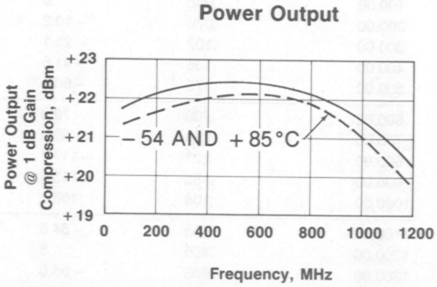
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	
BW	Frequency Range	10-1000	10-1000	10-1000	MHz
GP	Small Signal Gain	7.5	6.0 Min.	5.5 Min.	dB
—	Gain Flatness	±0.5	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	9.5	12.0 Max.	12.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+22.0	+20.0 Min.	+19.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+35.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+50.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+56.0	—	—	dBm
I_D	DC Current	110	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—







MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+17 dBm
Operating Case Temperature	−55°C to +85°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+85°C

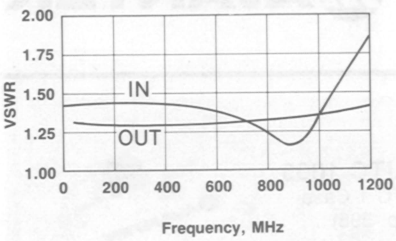
THERMAL CHARACTERISTICS*

θ_{JC}	80°C/W
Active Transistor Power Dissipation	770 mW
Junction Temperature Above Case Temperature	62°C
MTBF	793,867 Hrs.

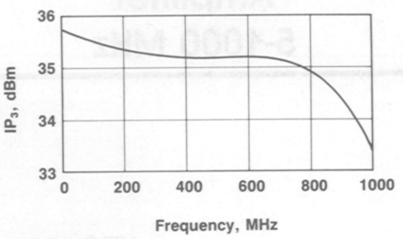
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

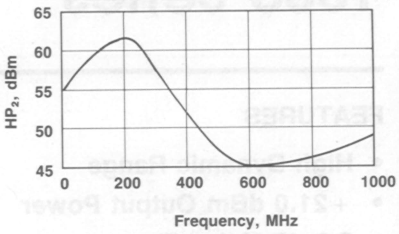
VSWR



Third-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.112	– 147.7	7.466	170.0	– 13.989	.6	.096	162.5
150.00	.119	– 145.4	7.528	164.2	– 14.037	– .3	.089	160.0
200.00	.134	– 143.5	7.502	159.6	– 14.085	– .6	.081	156.1
250.00	.156	– 142.9	7.514	154.4	– 14.090	– .9	.074	152.9
300.00	.173	– 142.5	7.530	149.2	– 14.070	– 1.8	.065	150.2
350.00	.187	– 143.6	7.514	144.5	– 14.066	– 1.7	.055	148.5
400.00	.201	– 145.9	7.485	139.6	– 13.989	– 2.0	.045	147.3
450.00	.217	– 147.3	7.444	134.7	– 14.020	– 2.6	.032	– 153.6
500.00	.228	– 148.1	7.413	129.7	– 14.012	– 1.8	.023	175.9
550.00	.230	– 149.7	7.406	124.7	– 13.892	– 2.4	.022	– 146.1
600.00	.234	– 153.8	7.406	119.7	– 13.882	– 3.0	.032	– 114.3
650.00	.243	– 157.3	7.404	114.9	– 13.809	– 3.0	.052	– 100.5
700.00	.251	– 158.9	7.435	109.7	– 13.700	– 3.7	.073	– 101.6
750.00	.251	– 158.4	7.444	104.6	– 13.588	– 4.3	.094	– 104.8
800.00	.235	– 158.8	7.402	99.1	– 13.491	– 5.4	.116	– 106.7
850.00	.215	– 162.7	7.401	93.9	– 13.323	– 5.5	.143	– 111.0
900.00	.204	– 168.2	7.414	88.1	– 13.163	– 7.6	.172	– 117.2
950.00	.198	– 170.9	7.423	82.3	– 13.035	– 7.8	.201	– 122.9
1000.00	.178	– 168.8	7.541	76.8	– 12.747	– 9.3	.231	– 128.6
1050.00	.142	– 166.0	7.464	70.8	– 12.589	– 10.7	.264	– 135.1
1100.00	.104	– 164.1	7.529	65.3	– 12.401	– 12.2	.298	– 142.7
1150.00	.069	– 158.2	7.619	58.0	– 12.194	– 14.2	.328	– 151.6
1200.00	.045	– 125.3	7.468	50.8	– 12.056	– 17.0	.358	– 160.7
1250.00	.069	– 70.7	7.501	44.6	– 11.968	– 20.2	.391	– 170.7
1300.00	.126	– 53.6	7.305	36.7	– 11.902	– 23.5	.425	178.6
1350.00	.189	– 50.1	6.982	29.6	– 11.872	– 28.1	.456	167.5
1400.00	.254	– 53.0	6.835	21.4	– 11.989	– 32.4	.477	156.6
1450.00	.323	– 57.4	6.151	12.9	– 12.248	– 36.7	.499	145.7
1500.00	.395	– 62.2	5.554	5.7	– 12.449	– 41.3	.518	134.7
1550.00	.466	– 66.6	4.856	– 2.3	– 12.898	– 46.0	.531	124.4
1600.00	.526	– 70.6	3.953	– 9.6	– 13.442	– 49.6	.536	115.2
1650.00	.573	– 75.1	2.901	– 16.1	– 14.000	– 53.2	.536	107.2
1700.00	.618	– 79.8	1.923	– 21.1	– 14.549	– 56.2	.533	99.8
1750.00	.664	– 84.4	.897	– 26.6	– 15.311	– 58.6	.530	93.0
1800.00	.700	– 87.2	– .254	– 30.9	– 15.864	– 58.3	.525	87.1
1850.00	.727	– 90.0	– 1.069	– 32.7	– 16.173	– 60.3	.519	82.3
1900.00	.750	– 93.3	– 1.915	– 36.4	– 16.808	– 62.6	.514	77.9
1950.00	.778	– 96.0	– 2.931	– 38.0	– 17.266	– 63.0	.508	74.2
2000.00	.801	– 98.4	– 3.549	– 40.1	– 17.782	– 66.2	.499	71.1

REF PLANES = 4.60 7.00 11.60

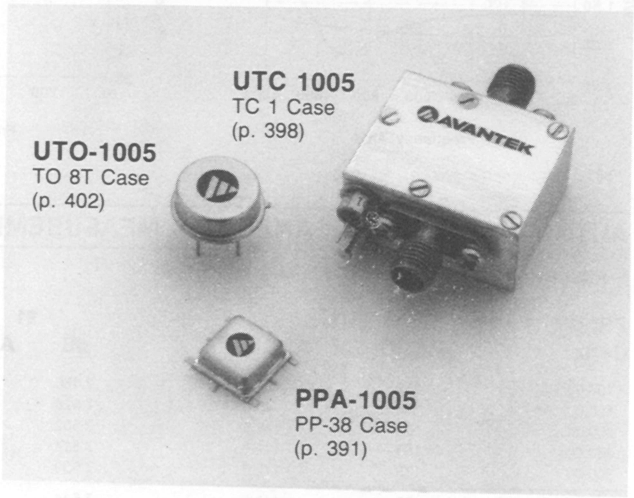
1005 Series

Thin Film Cascadable Amplifier 5-1000 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **+21.0 dBm Output Power**
- **5.0 dB Noise Figure**

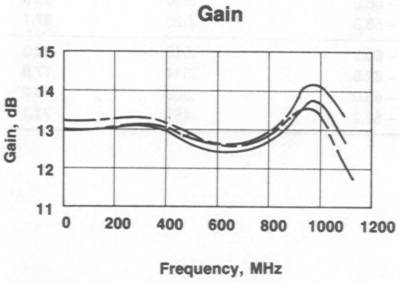


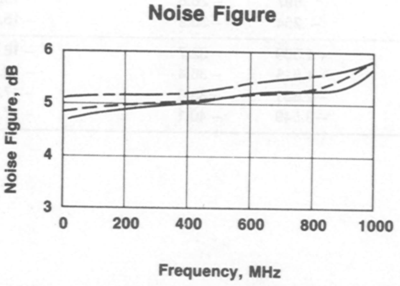
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

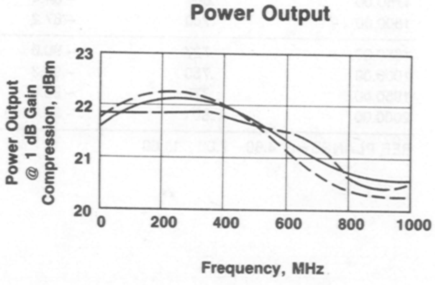
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = -55°- +85°C	Unit
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	12.6	11.0 Min.	10.5 Min.	dB
—	Gain Flatness	±0.3	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	5.0	6.0 Max.	6.5 Max.	dB
$P_{1 dB}$	Power Output @ + 1 dB Compression	+21.0	+20.0 Min.	+19.0 Min.	dBm
—	Input VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+35.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+45.0	—	—	dBm
I_D	DC Current	90	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C – – – –
−55°C —·—·—







MAXIMUM RATINGS

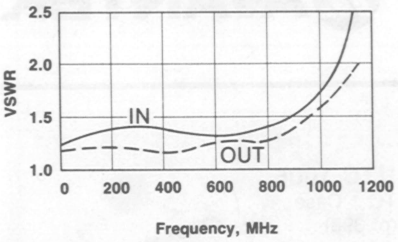
DC Voltage .... +17 Volts
Continuous RF Input Power .... +15 dBm
Operating Case Temperature .... -55°C to +115°C
Storage Temperature .... -62°C to +150°C
"R" Series Burn-In Temperature .... +115°C

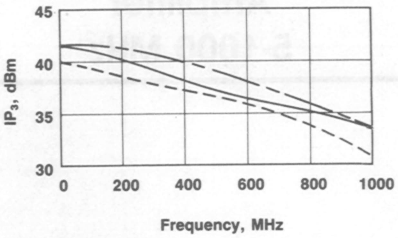
THERMAL CHARACTERISTICS*

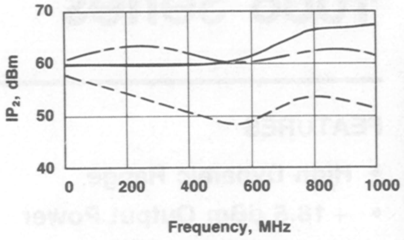
θ_{JC} .... 45°C/W
Active Transistor Power Dissipation .... 830 mW
Junction Temperature Above Case Temperature .... 37°C
MTBF .... 498,452 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) PPA — 0.5 grams; UTO — 2.1 grams; UTC — 21.5 grams


VSWR


Third-Order Intercept Point


Second-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.31	13.31	170.85	−.69	.00	1.07	17.87
150.0	1.30	13.14	164.96	−1.22	.32	1.08	18.09
200.0	1.29	13.04	159.42	−1.42	.31	1.09	18.06
250.0	1.29	12.97	153.67	−1.81	.30	1.09	18.05
300.0	1.28	12.83	148.73	−1.41	.27	1.09	18.10
350.0	1.28	12.74	143.94	−.85	.27	1.09	18.13
400.0	1.26	12.61	139.10	−.34	.27	1.10	18.23
450.0	1.25	12.53	134.09	.00	.27	1.09	18.35
500.0	1.24	12.50	129.46	.71	.26	1.09	18.43
550.0	1.23	12.52	124.83	1.43	.25	1.09	18.42
600.0	1.23	12.54	120.54	2.49	.24	1.10	18.67
650.0	1.25	12.57	116.05	3.35	.26	1.11	18.97
700.0	1.28	12.64	111.18	3.82	.28	1.12	19.36
750.0	1.32	12.73	106.07	4.05	.32	1.16	19.92
800.0	1.36	12.85	99.81	3.13	.36	1.21	20.64
850.0	1.38	13.05	93.14	1.80	.41	1.28	21.48
900.0	1.39	13.26	84.96	−1.02	.47	1.37	22.55
950.0	1.40	13.40	76.33	−4.31	.48	1.48	23.42
1000.0	1.43	13.55	67.57	−7.71	.54	1.60	23.46
1050.0	1.58	13.23	56.83	—	.58	1.71	22.69
1100.0	1.88	12.83	46.81	—	.57	1.82	21.94
1150.0	2.33	12.23	36.16	—	.57	1.86	21.29
1200.0	2.89	11.14	26.14	—	.48	1.87	20.77
1250.0	3.67	10.05	18.92	—	.44	1.84	20.56
1300.0	4.46	8.91	10.41	—	.41	1.79	20.66
1350.0	5.30	7.69	4.30	—	32	1.73	20.75
1400.0	6.18	6.65	−.94	—	.28	1.65	21.57
1450.0	7.18	5.42	−5.89	—	.25	1.58	22.17
1500.0	8.43	4.21	−9.78	—	.20	1.52	22.53

LINEARIZATION RANGE: 100.0 TO 1000.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.124	−170.0	13.316	169.8	−17.967	−2.2	.035	134.5
200.00	.131	−173.2	13.075	158.9	−17.958	−5.8	.038	119.3
300.00	.125	−173.9	12.887	148.4	−18.079	−9.2	.039	110.2
400.00	.115	−173.0	12.661	138.7	−18.224	−13.8	.036	95.5
500.00	.105	−167.6	12.522	129.3	−18.430	−19.3	.031	67.1
600.0	.098	−155.6	12.569	120.5	−18.674	−25.6	.037	26.7
700.00	.125	−144.1	12.683	111.3	−19.272	−32.2	.067	−1.8
800.00	.163	−154.1	12.927	99.9	−20.491	−38.2	.117	−23.5
900.00	.180	174.0	13.272	85.4	−22.339	−37.8	.186	−43.9
1000.00	.180	113.1	13.495	68.5	−23.134	−25.1	.254	−67.1
1100.00	.279	36.6	12.796	48.5	−21.647	−19.5	.302	−91.7
1200.00	.466	−12.0	11.269	27.9	−20.486	−25.7	.303	−115.7
1300.00	.633	−43.3	9.129	12.0	−20.358	−38.0	.274	−139.4
1400.00	.738	−65.4	6.834	.3	−21.262	−49.5	.232	−160.6
1500.00	.808	−80.8	4.320	−8.8	−22.363	−56.4	.190	177.9
1600.00	.850	−91.9	1.955	−15.3	−23.876	−62.9	.157	154.1
1700.00	.867	−100.5	−.364	−20.7	−24.976	−66.2	.148	128.5
1800.00	.877	−107.4	−2.485	−25.6	−26.442	−64.4	.158	108.3
1900.00	.883	−113.5	−4.374	−27.8	−27.140	−66.2	.179	92.6
2000.00	.967	−121.7	−5.778	−29.8	−27.628	−67.5	.220	80.6
2100.00	.978	−126.0	−7.555	−30.8	−28.498	−63.7	.250	73.8
2200.00	.980	−130.0	−9.321	−33.3	−29.495	−64.5	.280	69.2
2300.00	.975	−133.7	−10.759	−35.1	−29.340	−67.4	.300	66.4
2400.00	.973	−137.8	−12.602	−36.9	−30.389	−68.8	.322	62.1
2500.00	.969	−141.1	−14.529	−37.1	−31.776	−61.6	.339	60.2

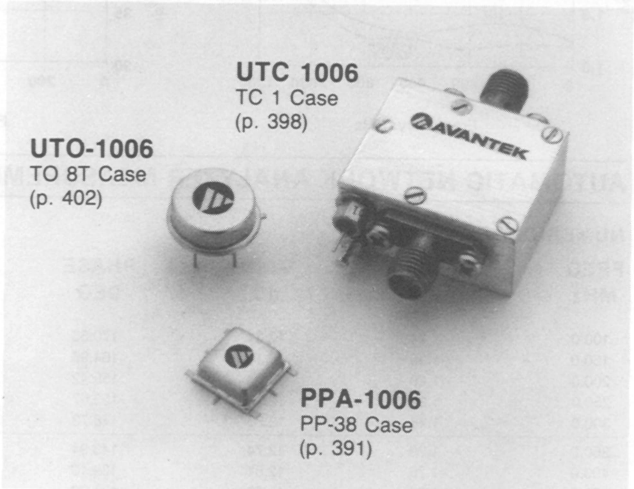
1006 Series

Thin Film Cascadable Amplifier
5-1000 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **+18.5 dBm Output Power**
- **4.8 dB Noise Figure**



UTC 1006
TC 1 Case
(p. 398)

UTO-1006
TO 8T Case
(p. 402)

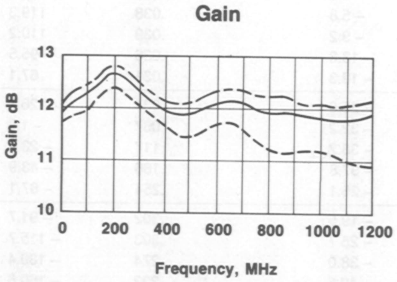
PPA-1006
PP-38 Case
(p. 391)

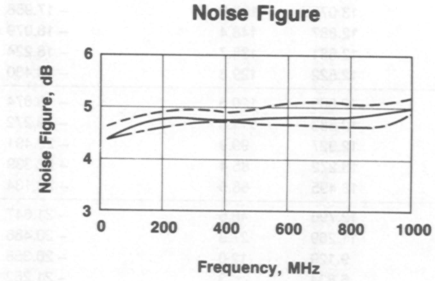
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

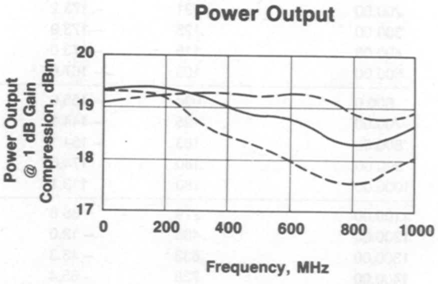
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	Guaranteed Specifications $T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	12.0	11.0 Min.	10.5 Min.	dB
—	Gain Flatness	±0.3	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.8	6.0 Max.	6.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+18.5	+17.0 Min.	+16.0 Min.	dBm
—	Input VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.2:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+30.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+40.0	—	—	dBm
I_D	DC Current	70	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ———
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	-55°C to +100°C
Storage Temperature	-62°C to +150°C
"R" Series Burn-In Temperature	+100°C

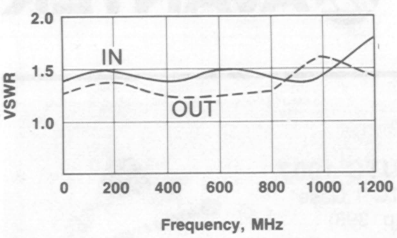
THERMAL CHARACTERISTICS*

θ_{JC}	85°C/W
Active Transistor Power Dissipation	640 mW
Junction Temperature Above Case Temperature	54°C
MTBF	579,341 Hrs.

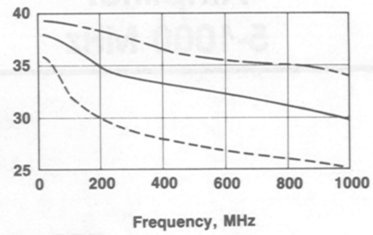
*For further information, see High Reliability section.

WEIGHT: (typical) PPA — 0.5 grams; UTO — 2.1 grams; UTC — 21.5 grams

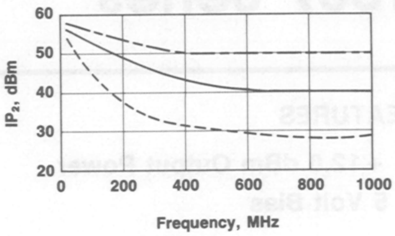
VSWR



Third-Order Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.44	12.63	170.36	−.01	.00	1.20	17.41
150.0	1.43	12.55	165.04	−.31	.29	1.20	17.30
200.0	1.42	12.46	159.97	−.35	.29	1.20	17.35
250.0	1.40	12.40	154.76	−.53	.28	1.20	17.42
300.0	1.38	12.34	149.83	−.43	.27	1.19	17.46
350.0	1.36	12.27	145.02	−.22	.27	1.18	17.51
400.0	1.34	12.20	139.96	−.25	.28	1.16	17.54
450.0	1.33	12.13	135.07	−.11	.27	1.15	17.61
500.0	1.32	12.10	130.23	.07	.27	1.12	17.59
550.0	1.31	12.12	125.50	.36	.26	1.10	17.54
600.0	1.29	12.13	120.91	.81	.26	1.07	17.47
650.0	1.27	12.11	116.24	1.17	.27	1.04	17.35
700.0	1.27	12.09	111.20	1.16	.28	1.03	17.27
750.0	1.27	12.04	106.16	1.15	.29	1.06	17.17
800.0	1.28	11.97	100.68	.69	.31	1.10	17.13
850.0	1.27	11.97	95.13	.17	.31	1.14	17.10
900.0	1.27	11.96	89.38	−.55	.32	1.19	16.94
950.0	1.28	11.96	83.76	−1.13	.31	1.24	16.95
1000.0	1.28	12.06	78.20	−1.67	.31	1.30	16.85
1050.0	1.28	11.99	72.66	–	.32	1.36	16.78
1100.0	1.29	12.03	66.85	–	.36	1.42	16.72
1200.0	1.36	11.88	52.69	–	.39	1.55	16.39
1300.0	1.58	11.73	37.09	–	.47	1.72	16.22
1400.0	2.11	11.37	18.41	–	.54	1.95	16.52
1500.0	3.20	10.30	−.79	–	.57	2.23	17.43
1600.0	5.16	8.32	−20.98	–	.51	2.61	18.99
1700.0	7.80	5.94	−38.40	–	.44	2.95	20.62
1800.0	10.73	3.46	−50.25	–	.32	3.25	22.50
1900.0	13.12	.79	−62.74	–	.30	3.60	23.46
2000.0	15.53	−1.82	−74.60	–	.00	3.76	24.62

LINEARIZATION RANGE: 100.0 TO 1000.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.0	.184	−177.9	12.616	170.2	−17.438	−1.3	.093	164.3
200.00	.174	176.9	12.453	159.8	−17.342	−2.3	.089	151.6
300.00	.161	176.3	12.369	149.6	−17.451	−3.9	.085	138.9
400.00	.152	177.7	12.265	139.6	−17.464	−6.0	.076	126.1
500.00	.143	−179.2	12.222	129.3	−17.503	−8.5	.064	110.8
600.00	.131	−172.5	12.195	119.4	−17.384	−11.6	.046	98.9
700.00	.142	−162.1	12.085	109.4	−17.275	−14.6	.017	79.6
800.00	.142	−156.6	11.907	98.8	−17.171	−17.5	.022	−90.5
900.00	.141	−149.4	11.869	87.2	−17.050	−21.6	.069	−108.1
1000.00	.154	−138.0	11.954	76.0	−16.958	−24.6	.126	−121.5
1100.00	.159	−124.6	11.904	64.2	−16.872	−29.7	.186	−137.4
1200.00	.185	−108.7	11.761	49.3	−16.509	−36.6	.243	−158.5
1300.00	.258	−93.3	11.526	32.6	−16.393	−45.8	.306	172.1
1400.00	.398	−90.1	11.044	12.7	−16.885	−60.1	.370	136.0
1500.00	.572	−96.1	9.645	−7.7	−18.062	−75.1	.432	96.5
1600.00	.711	−107.1	7.102	−29.2	−20.192	−87.9	.491	60.7
1700.00	.786	−119.3	3.872	−46.4	−22.673	−95.7	.531	31.7
1800.00	.786	−133.4	−.551	−55.2	−26.297	−92.6	.556	6.9
1900.00	.383	−136.6	−.896	−23.7	−25.231	−54.9	.532	−14.4
2000.00	.788	−112.6	−.753	−65.2	−23.488	−89.8	.562	−26.9

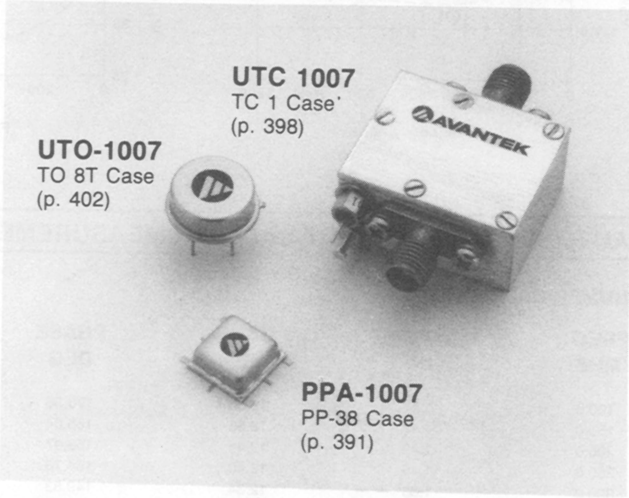
1007 Series

Thin Film Cascadable Amplifier 5-1000 MHz

AVANTEK

FEATURES

- **+12.0 dBm Output Power**
- **5 Volt Bias**

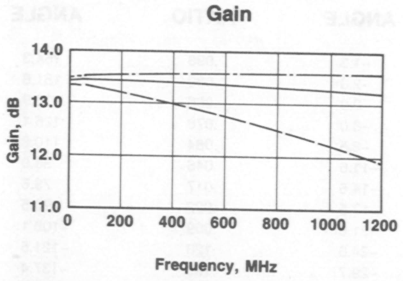


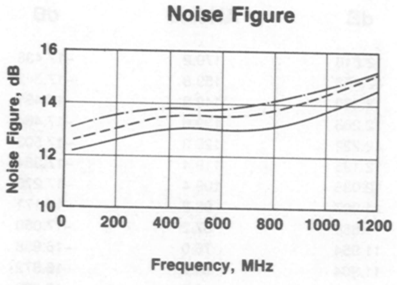
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +5 VDC nominal unless otherwise noted)

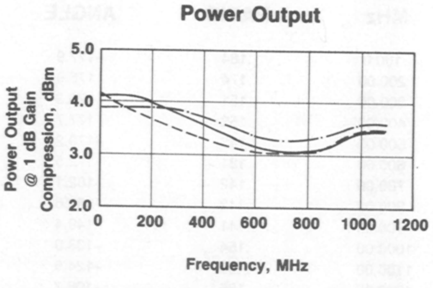
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-}+85°C$	Unit
BW	Frequency Range	5-1200	5-1000	5-1000	MHz
GP	Small Signal Gain	13.5	12.5 Min.	11.5 Min.	dB
—	Gain Flatness	±0.1	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	3.8	5.0 Max.	5.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+12.0	+11.0 Min.	+10.0 Min.	dBm
—	Input VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+21.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+21.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+28.0	—	—	dBm
I_D	DC Current	33	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +5 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—







MAXIMUM RATINGS

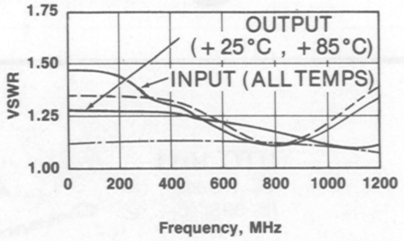
DC Voltage	+10 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

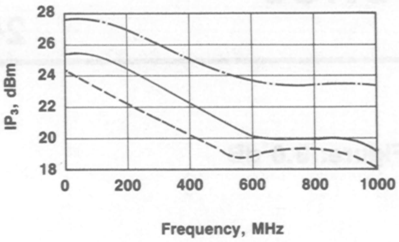
THERMAL CHARACTERISTICS*

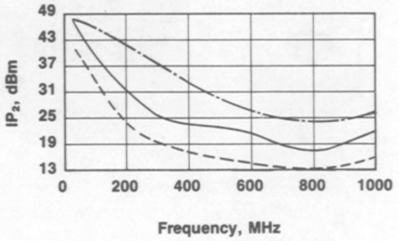
θ_{JC}	105°C/W
Active Transistor Power Dissipation	110 mW
Junction Temperature Above Case Temperature	11.4°C

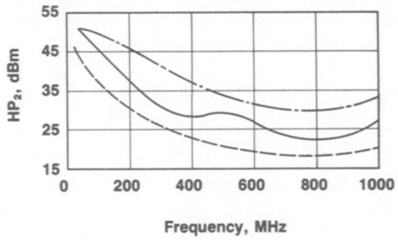
*For further information, see High Reliability section.

WEIGHT: (typical) PPA — 0.5 grams; UTO — 2.1 grams; UTC — 21.5 grams


VSWR


Third-Order Intercept Point


Second-Order Intercept Point


Second Harmonic Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	PHASE DEG	GAIN dB	PHASE DEG	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.46	166.73	13.90	-.31	.00	1.28	19.39
200.0	1.31	152.58	13.66	-1.11	.37	1.27	18.15
300.0	1.32	139.76	13.82	-.58	.36	1.25	18.36
400.0	1.25	126.72	13.61	-.29	.35	1.24	18.59
500.0	1.20	114.26	13.65	.58	.34	1.19	18.31
600.0	1.14	102.22	13.72	1.89	.35	1.16	18.19
700.0	1.06	88.96	13.66	1.96	.38	1.15	18.14
800.0	1.09	74.69	13.45	1.06	.41	1.11	18.03
900.0	1.16	59.41	13.42	-.88	.42	1.06	17.90
1000.0	1.26	44.64	13.48	-2.31	.41	1.04	17.83
1200.0	1.60	12.61	13.32	—	.47	1.18	17.85
1400.0	2.57	-23.11	13.00	—	.53	1.47	18.20
1600.0	6.10	-64.48	11.17	—	.60	2.03	19.81
1800.0	25.80	-104.99	8.00	—	.48	2.63	21.54
2000.0	88.94	-135.14	4.10	—	.00	3.14	22.93

LINEARIZATION RANGE: 100.0 TO 1000.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 5.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.170	170.2	13.870	168.9	– 18.380	– 2.1	.117	158.2
200.00	.147	155.0	13.762	156.3	– 18.454	– 7.1	.116	132.7
300.00	.123	142.9	13.754	144.5	– 18.224	– 11.2	.112	111.2
400.00	.094	127.4	13.756	132.7	– 18.194	– 16.0	.108	87.8
500.00	.069	110.5	13.821	121.6	– 18.042	– 20.6	.106	66.8
600.00	.048	72.1	13.822	110.7	– 17.984	– 25.4	.101	43.1
700.00	.045	25.1	13.657	98.6	– 17.959	– 30.2	.090	17.4
800.00	.064	– 10.0	13.486	84.9	– 18.041	– 35.4	.072	– 11.4
900.00	.091	– 28.5	13.458	70.9	– 17.926	– 41.1	.054	– 48.2
1000.00	.124	– 36.4	13.431	57.3	– 18.029	– 47.0	.037	– 106.5
1100.00	.161	– 43.2	13.368	42.3	– 17.932	– 54.3	.057	176.1
1200.00	.210	– 48.1	13.250	26.5	– 17.836	– 61.7	.113	135.4
1300.00	.275	– 52.1	12.931	9.2	– 18.122	– 69.7	.180	102.3
1400.00	.357	– 58.2	12.369	– 10.1	– 18.616	– 80.6	.261	73.4
1500.00	.455	– 66.9	11.215	– 29.9	– 19.290	– 90.4	.343	45.9
1600.00	.556	– 76.7	9.380	– 49.3	– 20.354	– 100.1	.404	20.4
1700.00	.630	– 87.8	7.417	– 66.8	– 21.351	– 106.9	.436	– 3.0
1800.00	.679	– 98.1	5.462	– 78.1	– 22.819	– 107.9	.454	– 24.0
1900.00	.714	– 107.6	3.348	– 88.5	– 23.328	– 112.1	.458	– 41.5
2000.00	.741	– 116.1	1.435	– 97.7	– 24.279	– 115.2	.452	– 57.6

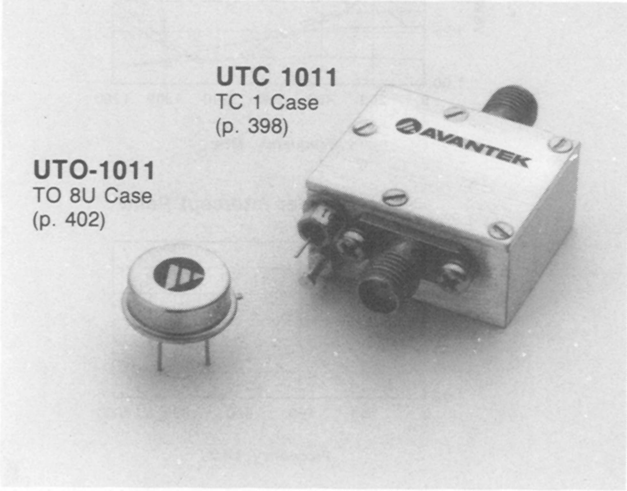
1011 Series

Thin Film Cascadable Amplifier 2-1000 MHz

AVANTEK

FEATURES

- **Low Noise Figure: 3.0 dB**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

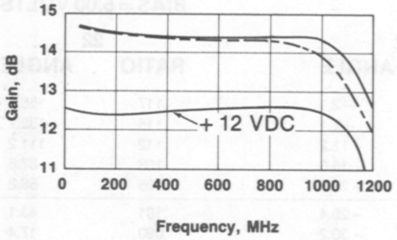
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	2-1000	2-1000	2-1000	MHz
GP	Small Signal Gain	14.5	14.0 Min.	13.5 Min.	dB
—	Gain Flatness	±0.5	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	3.0	3.5 Max.	4.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	−2.0	−5.0 Min.	−6.0 Min.	dBm
—	Input VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<2.0:1	2.2:1 Max.	2.2:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+10.0	—	—	dBm
I_D	DC Current	8	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

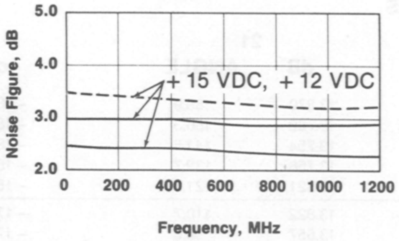
KEY:

+25°C	———
+85°C	— — —
−55°C	—·—·—

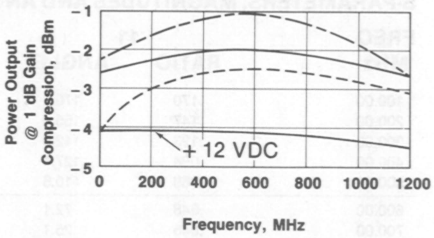
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

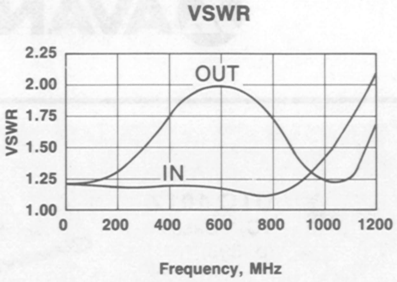
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	165°C/W
Active Transistor Power Dissipation	44 mW
Junction Temperature Above Case Temperature	7.3°C
MTBF	1,112,818 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	ISOL dB	VSWR OUT
100.0	1.18	14.46	162.04	− 8.68	.00	19.44	1.21
150.0	1.18	14.40	153.79	− 7.54	.46	19.47	1.30
200.0	1.20	14.32	145.52	− 6.40	.45	19.47	1.39
250.0	1.20	14.25	137.56	− 4.94	.44	19.45	1.49
300.0	1.21	14.20	129.68	− 3.44	.44	19.45	1.58
350.0	1.21	14.10	121.56	− 2.15	.41	19.41	1.67
400.0	1.22	14.05	114.76	.45	.41	19.34	1.76
450.0	1.21	14.00	106.69	1.78	.45	19.27	1.83
500.0	1.21	14.00	98.59	3.07	.45	19.18	1.90
550.0	1.20	14.00	90.45	4.34	.46	19.05	1.95
600.0	1.19	14.05	82.00	5.30	.47	18.96	1.97
650.0	1.17	14.08	73.36	6.05	.48	18.88	1.97
700.0	1.15	14.14	64.55	6.65	.49	18.82	1.96
750.0	1.12	14.20	55.65	7.15	.50	18.78	1.91
800.0	1.11	14.26	46.42	7.32	.52	18.77	1.82
850.0	1.12	14.31	36.76	7.07	.54	18.77	1.70
900.0	1.17	14.33	26.89	6.61	.57	18.85	1.59
950.0	1.26	14.32	16.32	5.43	.60	18.98	1.44
1000.0	1.38	14.20	5.33	3.84	.62	19.29	1.31
1050.0	1.53	13.99	− 5.94	1.98	.63	19.56	1.24
1100.0	1.70	13.64	− 17.43	− .10	.64	20.03	1.29
1150.0	1.90	13.17	− 28.87	− 2.14	.63	20.55	1.47
1200.0	2.10	12.51	− 40.24	− 4.11	.62	21.14	1.72
1250.0	2.30	11.76	− 51.16	− 5.62	.58	21.64	2.00
1300.0	2.49	10.90	− 61.05	− 6.11	.53	22.14	2.31
1350.0	2.64	9.94	− 70.29	− 5.95	.49	22.53	2.68
1400.0	2.75	9.02	− 78.82	− 5.08	.45	22.75	3.06
1450.0	2.84	8.03	− 86.65	− 3.51	.42	22.82	3.38
1500.0	2.90	7.11	− 93.80	− 1.26	.00	22.84	3.71

LINEARIZATION RANGE: 100.0 TO 1500.0

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.097	− 175.5	14.689	162.7	− 19.747	− 6.8	.108	119.5
200.00	.105	179.1	14.499	145.7	− 19.718	− 13.0	.173	85.9
300.00	.108	175.2	14.425	128.7	− 19.394	− 19.7	.231	66.4
400.00	.111	171.2	14.395	112.7	− 19.471	− 26.6	.279	50.9
500.00	.106	165.6	14.327	96.9	− 19.247	− 34.4	.312	35.6
600.00	.097	161.7	14.327	80.9	− 19.051	− 42.4	.331	20.8
700.00	.078	160.3	14.335	64.0	− 18.834	− 51.3	.324	4.6
800.00	.058	− 176.3	14.402	45.9	− 18.793	− 61.3	.292	− 14.4
900.00	.073	− 135.6	14.415	25.8	− 18.669	− 72.6	.228	− 39.2
1000.00	.151	− 126.6	14.222	3.7	− 19.053	− 84.8	.134	− 82.7
1100.00	.251	− 137.8	13.582	− 20.1	− 19.685	− 96.2	.124	179.0
1200.00	.350	− 153.0	12.409	− 43.1	− 20.714	− 105.0	.259	124.3
1300.00	.415	− 169.2	10.704	− 63.7	− 21.525	− 110.5	.399	95.9
1400.00	.451	177.7	8.849	− 82.6	− 22.087	− 114.7	.503	74.5
1500.00	.468	165.7	7.090	− 97.4	− 22.175	− 118.8	.583	58.1

TYPICAL PERFORMANCE AT 25°C

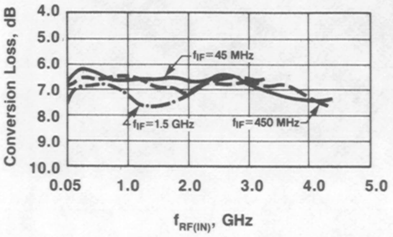
Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

5	>70	>70	>70	>70	>70
4	>70	>70	>70	>70	>70
3	65	>70	60	>70	65
2	55	45	55	58	55
1	0	35	18	45	30
	1	2	3	4	5

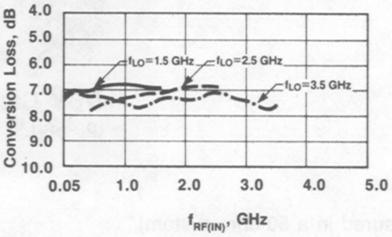
Harmonics of f_{LO}

Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level of −10 dBm and f_{LO} signal level of +10 dBm for "M" suffix mixers, and +17 dBm for "H" suffix mixers.

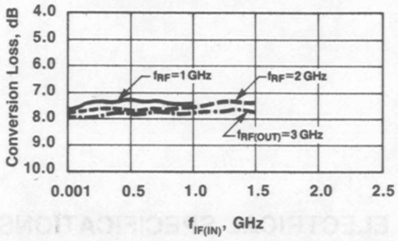
Conversion Loss vs. Frequency
$f_{LO} > f_{RF}$



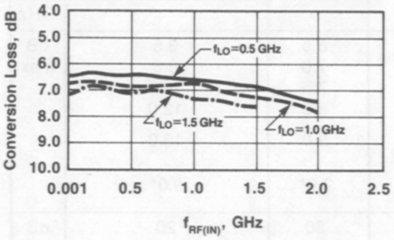
Conversion Loss vs. Frequency
$f_{IF} = f_{LO} - f_{RF}$, $f_{LO} > f_{IF}$



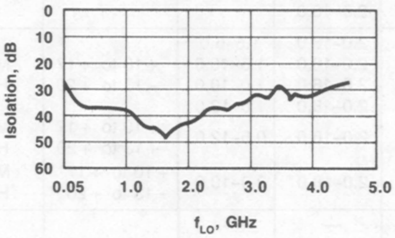
Conversion Loss vs. Frequency
$f_{RF(OUT)} > f_{LO}$, $f_{RF(OUT)} > f_{IF(IN)}$



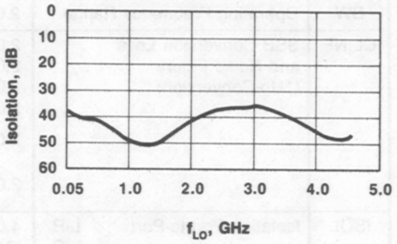
Conversion Loss vs. Frequency
$f_{RF} = f_{LO} + f_{IF}$, $f_{RF(OUT)} > f_{LO}$, $f_{RF(OUT)} > f_{IF}$



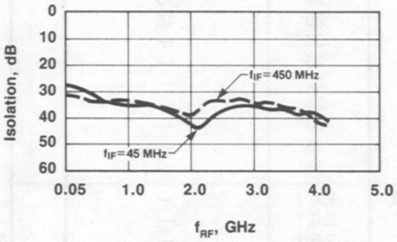
Port-to-Port Isolation vs. Frequency
L-R



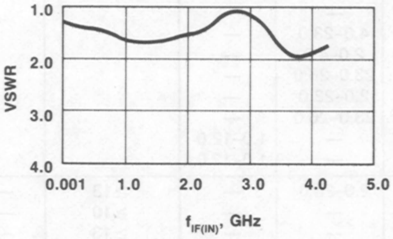
Port-to-Port Isolation vs. Frequency
L-I



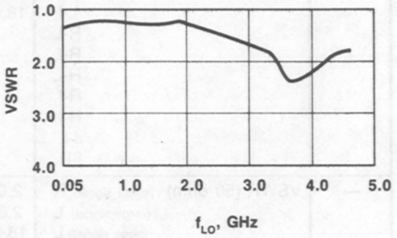
Port-to-Port Isolation vs. Frequency
R-I



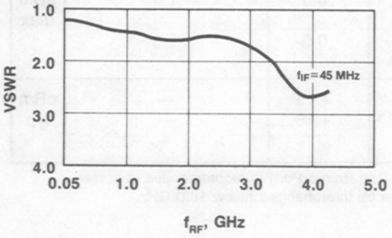
I Port VSWR vs. Frequency
$P_{IF} = -10$ dBm, $P_{LO} = +10$ dBm, $f_{LO} = f_{IF} + 45$ MHz



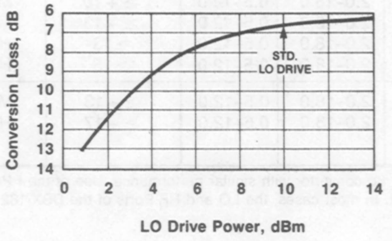
L Port VSWR vs. Frequency
$P_{LO} = +10$ dBm



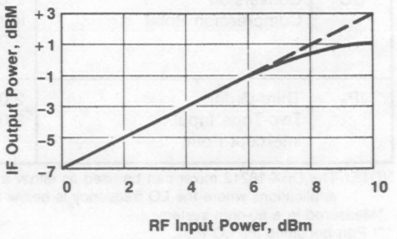
R Port VSWR vs. Frequency
$P_{RF} = -10$ dBm, $P_{LO} = +10$ dBm,
$f_{LO} = f_{RF} + 45$ MHz



Conversion Loss vs. LO Power
$f_{LO} = 1.5$ GHz, $f_{RF} = 1.0$ GHz @ −10 dBm,
$f_{IF} = 500$ MHz



IF Output vs. RF Input Level
$f_{RF} = 1000$ MHz, $f_{LO} = 1500$ MHz @ +10 dBm,
$f_{IF} = 500$ MHz



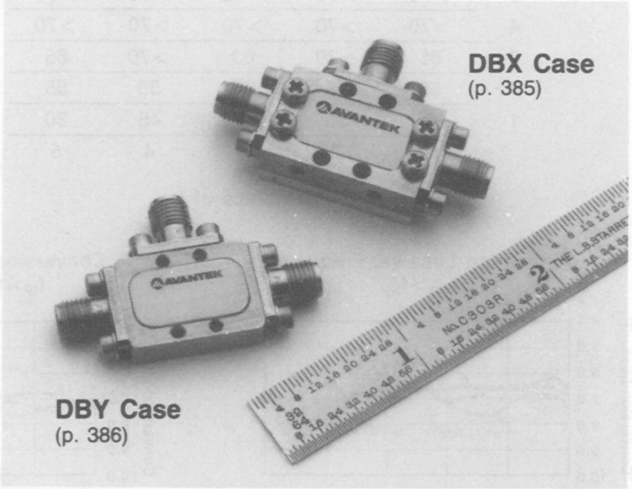
DBX-18212M/H
DBY-18212M/H

Avanpak
Double Balanced Mixer
2-18 GHz

AVANTEK

FEATURES

- **2 to 26 GHz LO Bandwidth**
- **2 to 18 GHz RF Bandwidth**
- **1 to 12 GHz IF Bandwidth**
- **7 dB Conversion Loss/Noise Figure**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic	Operating Frequencies, GHz			Power Level			Specifications		Unit
		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range	2.0–18.0	2.0–18.0							GHz
CL,NF	SSB Conversion Loss and Noise Figure (*Up-Conversion)	2.0–18.0	2.0–18.0	1.5–6.0				6.5	8.5	dB max
		2.0–18.0	2.0–18.0	1.5–10.0	+10 to +17	M		7.0	9.5	
		2.0–18.0	2.0–18.0	1.0–10.0	−13 to +20	H		7.5	10.0	
		2.0–18.0	2.0–18.0	1.0–12.0				8.5	12.0	
		2.0–18.0	2.0–18.0	0.5–12.0	+10 to +17 +13 to +20	M H		9.0	12.0	
		2.0–18.0	2.0–18.0	2.0–10.0	+10 to +17** +13 to +20**	M H		7.0*	9.0*	
ISOL	Isolation Port-to-Port L-R	4.0–23.0	—	—				30	20	dB min
	L-R	2.0–4.0	—	—				25	18	
	L-R	23.0–26.0	—	—				20	15	
	L-I	4.0–8.0	—	—				25	20	
	L-I	12.0–18.0	—	—				25	20	
	L-I	2.0–4.0	—	—				20	15	
	L-I	8.0–12.0	—	—				20	15	
	L-I	18.0–26.0	—	—				20	15	
	R-L	—	4.0–23.0	—				30	—	
	R-L	—	2.0–4.0	—				25	—	
	R-L	—	23.0–26.0	—				20	—	
	R-I	—	2.0–23.0	—				25	—	
	R-I	—	23.0–26.0	—				20	—	
	I-L	—	—	1.0–12.0				25	—	
	I-R	—	—	1.0–12.0				25	—	
—	VSWR (50 ohm) (small signal) R	2.0–18.0	2.0–26.0	—	≥13	—	≤0	2.0:1	—	
	(large signal) L	2.0–18.0	—	—	≥10	—	—	2.0:1	—	
	(large signal) L	18.0–26.0	—	—	≥13	—	—	2.5:1	—	
	(small signal) I	2.0–26.0	—	0.6–14.0	≥13	—	≤0	2.0:1	—	
	(large signal) I	—	—	2.0–14.0	—	—	≥ +10	2.0:1	—	
	(large signal) R	—	2.0–18.0	—	—	—	≥ +10	2.0:1	—	
	(large signal) R	—	18.0–26.0	—	—	—	≥ +13	2.0:1	—	
CC	Conversion Compression Point	2.0–18.0	2.0–18.0	0.5–12.0	≥ +10	M	+4	0.5	1.0	dBm max
		18.0–26.0	2.0–18.0	0.5–12.0	≥ +13	M	+4			
		2.0–18.0	2.0–18.0	0.5–12.0	≥13	H	+6	0.5	1.0	
		18.0–16.0	2.0–18.0	0.5–12.0	≥15	H	+6			
IP_3	Third-Order Two-Tone Input Intercept Point	2.0–26.0	2.0–18.0	0.5–12.0	≥ +13	M	—	+15	—	dBm typ
		2.0–26.0	2.0–18.0	0.5–12.0	≥ +17	H	—	+18	—	

NOTE: The DBX-18212 mixer can be used as either a down or up converter with similar performance. Use of the I Port as a LO Port (pump Port) is recommended in some applications where the LO frequency is below 10.0 GHz. In most cases, the LO and RF Ports of the DBX-18212 mixer can be interchanged below 18.0 GHz.

*Measured in a 50-ohm system.

**I Port becomes the LO Port.

WEIGHT: (typical) DBX—22 grams; DBY—16 grams

MAXIMUM RATINGS

Peak Input Current @ 25°C	200 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	−55°C to +100°C
Storage Temperature	−65°C to +100°C
Continuous RF Input Power	400 mW @ +25°C 200 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

TYPICAL PERFORMANCE AT 25°C

Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

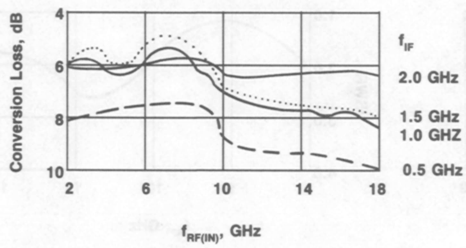
Harmonics of f_{RF}						
6	>70	>70	>70	>70	>70	>70
5	>70	>70	>70	>70	>70	>70
4	>70	>70	>70	>70	>70	>70
3	65	>70	60	>70	65	>70
2	55	55	55	58	55	60
1	0	35	18	40	35	45
	1	2	3	4	5	6

Harmonics of f_{LO}

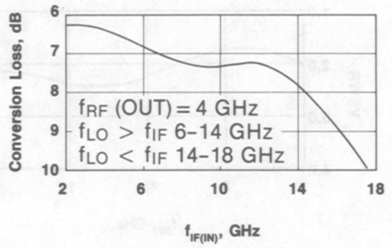
Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at −10 dBm and f_{LO} signal level of:

M Suffix .... +10 dBm
H Suffix .... +13 dBm

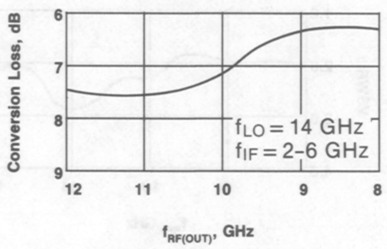
Conversion Loss



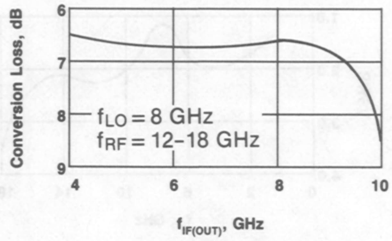
Conversion Loss



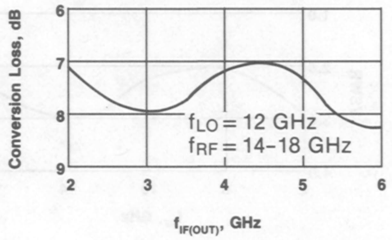
Conversion Loss



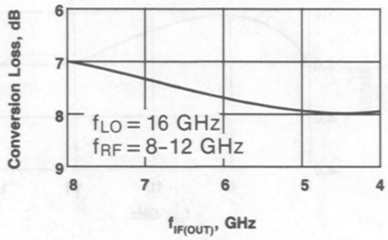
Conversion Loss



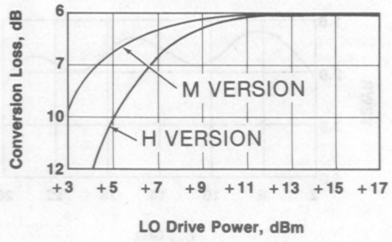
Conversion Loss



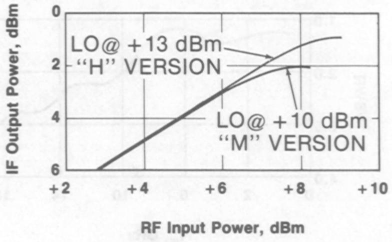
Conversion Loss



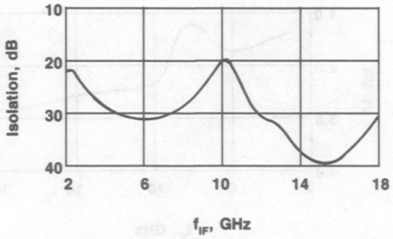
Conversion Loss
f_{LO} = 6 GHz, f_{RF} = 8 GHz



IF Output vs. RF Input Level

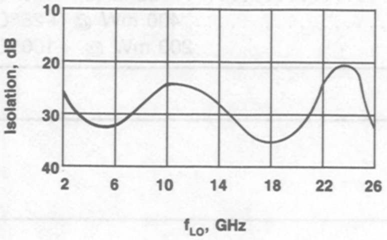


I Port to R Port Isolation

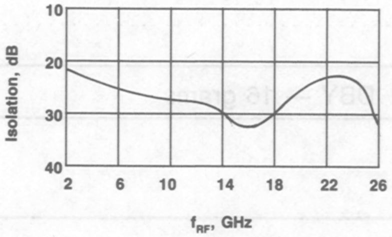


TYPICAL PERFORMANCE (continued)

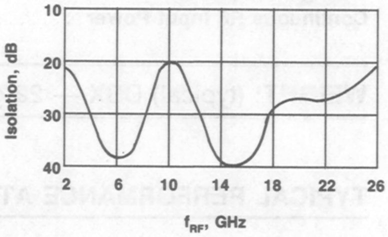
L Port to R Port Isolation



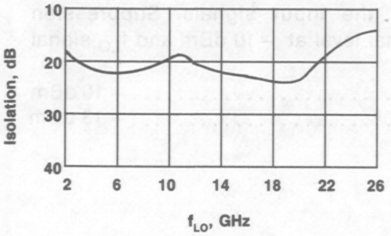
R Port to L Port Isolation



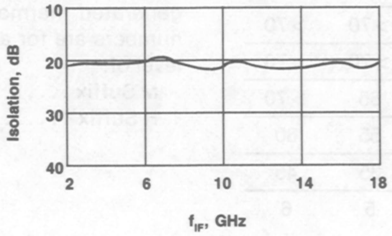
R Port to I Port Isolation



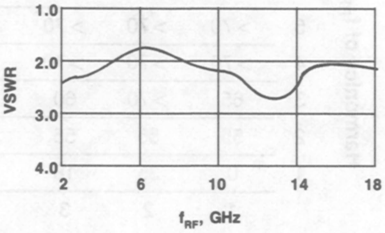
L Port to I Port Isolation



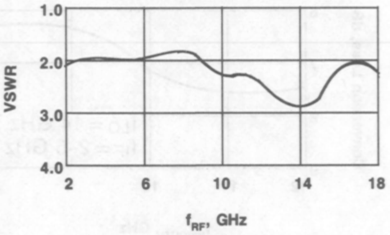
I Port to L Port Isolation



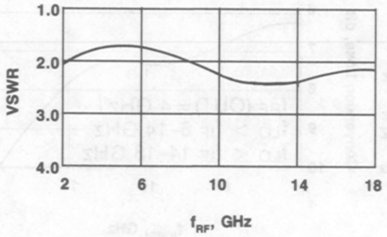
R Port VSWR
f_{LO} = 14 GHz @ +10 dBm



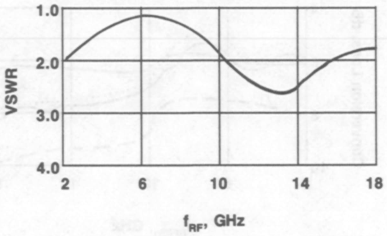
R Port VSWR
f_{LO} = 16 GHz @ +10 dBm



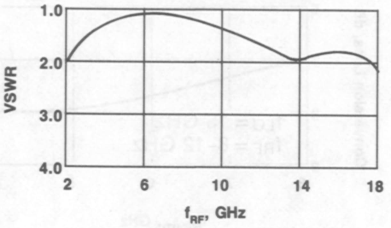
R Port VSWR
f_{LO} = 18 GHz @ +10 dBm



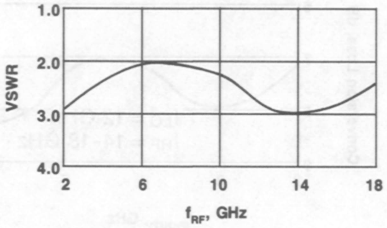
R Port VSWR
f_{LO} = 20 GHz @ +13 dBm



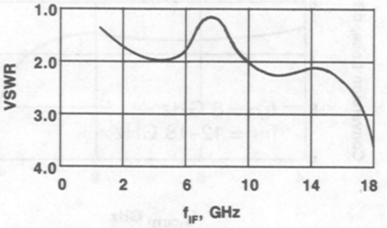
R Port VSWR
f_{LO} = 23 GHz @ +13 dBm



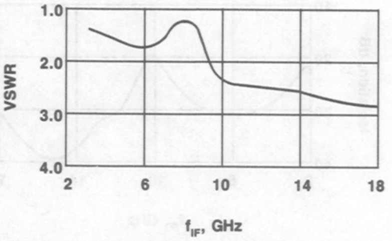
R Port VSWR
f_{LO} = 26 GHz @ +13 dBm



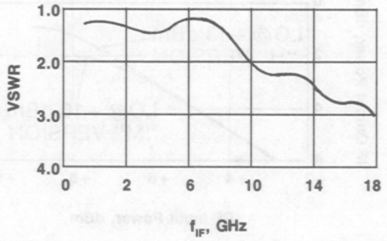
I Port VSWR
f_{LO} = 14 GHz @ +10 dBm



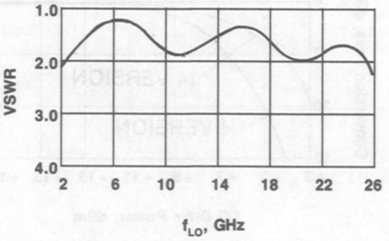
I Port VSWR
f_{LO} = 16 GHz @ +10 dBm



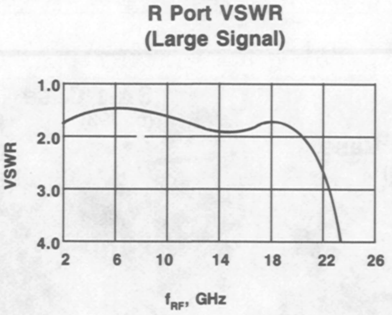
I Port VSWR
f_{LO} = 18 GHz @ +10 dBm

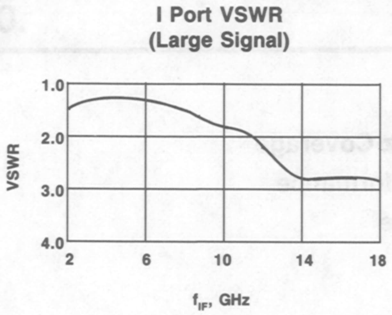


L Port VSWR
(Large Signal)



TYPICAL PERFORMANCE (continued)


R Port VSWR
(Large Signal)


I Port VSWR
(Large Signal)

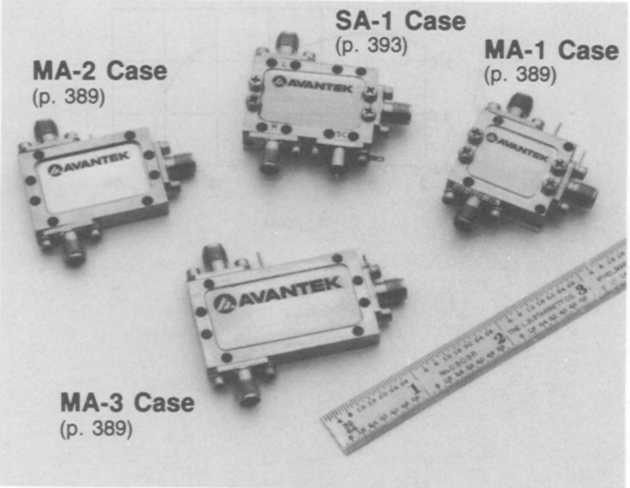
MXA Series

Avanpak
Mixer-Preamplifiers
.05-18 GHz

AVANTEK

FEATURES

- **.05 to 18 GHz Coverage**
- **Premium Performance**
- **Miniature Size**



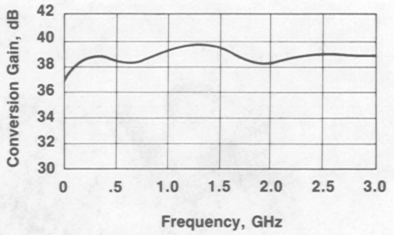
AVANPAK MIXER-PREAMPLIFIERS[1] (Guaranteed Specifications at 25°C Case Temperature)

Model Number	Consisting of the Following Products	Frequency Range f_{RF} (GHz)	f_{LO} (GHz)	f_{IF} (MHz)	RF-IF Gain (dB) Min.	Noise Figure (dB) Typ.	Power Output for 1 dB Gain Compression (dBm) Min.	DC Current (mA) Typ.	Case Drawing
MXA-2512	DBX-3503, UTO-210, UTO-210	.5–2.0	.5–2.0	10–200	10	11	8	30	MA-3
MXA-3012	DBX-3503, UTO-1012, UTO-1013	.05–3.0	.05–3.5	10–1000	22	10.5	9	50	MA-2
MXA-3013	DBX-3503, UTO-1012, UTO-1013, UTO-1006	.05–3.0	.05–3.5	10–1000	33	10.5	17	120	MA-3
MXA-7202	DBX-72M, UTO-514, UTO-516	2–7	2–7	30–160	22	8.5	9	45	MA-2
MXA-7203	DBX-72M, UTO-514, UTO-519, UTO-509	2–7	2–7	30–160	33	8.5	20	135	MA-3
MXA-8203	DBX-1824, UTO-210, UTO-210, UTO-210	2–8	2–8	10–200	18	11	12	45	MA-3
MXA-10911	DBX-186M, UTO-222	9–10	9–10	70	20	9	19	50	MA-1
MXA-18422	DBX-184M, UTO-2012, UTO-2012	4–18	4–18	500–2000	9	11.5	12	100	MA-2
MXA-18423	DBX-184M, UTO-2012, UTO-2012, UTO-2013	4–18	4–18	500–2000	18	11.5	19	200	MA-3
MXA-18662	DBX-18212M, AFT-6232	6–18	8–16	2000–6000	9	12	10	100	MA-2
MXA-18663	DBX-18212M, AFT-6233	6–18	8–16	2000–6000	18	12	10	150	MA-3
MXA-18803	DBX-1824, UTO-210, UTO-210	8–18	8–18	10–200	10	11	8	30	MA-3
MXA-18201	DBX-1824M, UTO-222	2–18	2–18	10–200	18	10.5	20	50	MA-1
MXA-18202	DBX-1824M, UTO-511, UTO-516	2–18	2–18	10–250	22	9.5	9	45	MA-2
MXA-18203	DBX-1824M, UTO-511, UTO-516, UTO-509	2–18	2–18	10–250	37	9.5	20	135	MA-3
MXA-18241	DBX-1824M, AFT-4231	2–18	2–18	2000–4000	2	11.5	2	50	SA-1

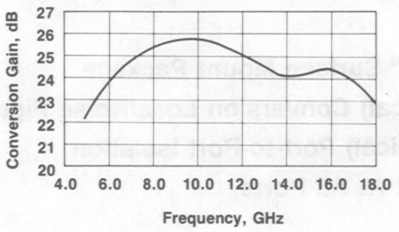
(1) Sample Listing

WEIGHT: (typical) MA-1 = 40 grams; MA-2 = 50 grams; MA-3 = 60 grams; SA-1 = 40 grams

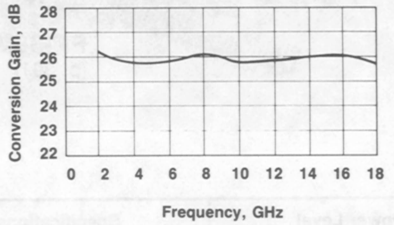
Guaranteed Specification at 25°C Case Temperature



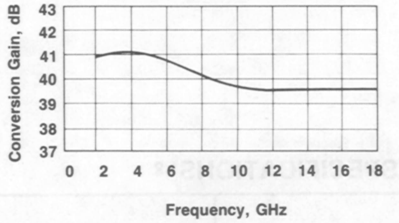
MXA-3013
Conversion Gain
$f_{LO} > f_{RF}$; $f_{IF} = 500$ MHz



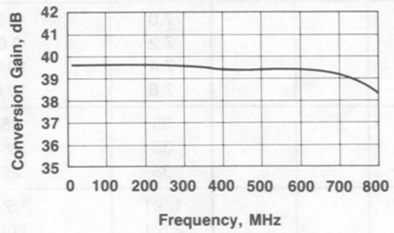
MXA-18423
Conversion Gain
$f_{LO} < f_{RF}$; $f_{IF} = 1.0$ GHz



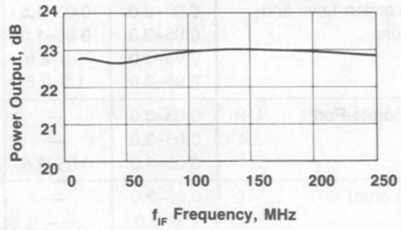
MXA-18202
Conversion Gain
$f_{LO} < f_{RF}$; $f_{IF} = 160$ MHz



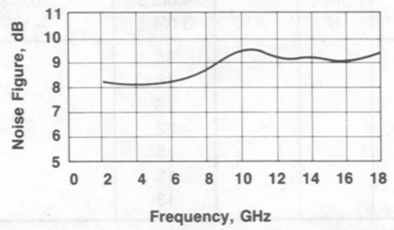
MXA-18203
Conversion Gain
$f_{LO} < f_{RF}$; $f_{IF} = 60$ MHz



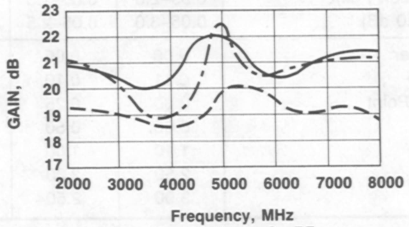
MXA-18203
Conversion Gain vs. f_{IF}
$f_{LO} < f_{RF}$; $f_{LO} = 11.990$ MHz



MXA-18203
Power Output @ 1 dB, Gain Compression
$f_{RF} > f_{LO}$, $f_{LO} = 8$ GHz



MXA-18203
Single Sideband Noise Figure
$f_{RF} < f_{LO}$; $f_{IF} = 250$ MHz



MXA-18205
Conversion Gain

IF = 100 MHz; LO > RF

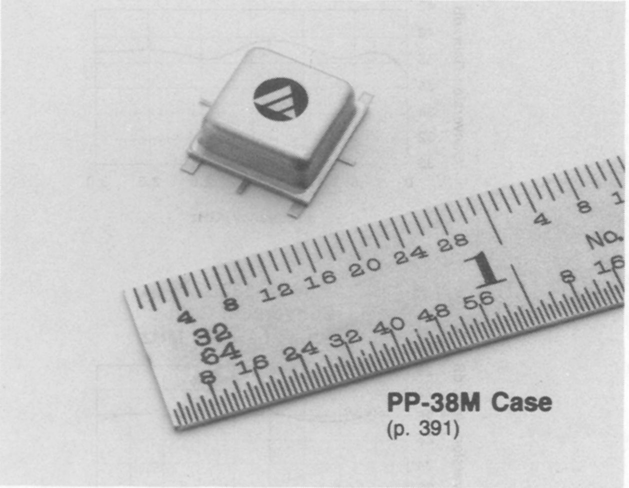
PPM-2515M
(PRELIMINARY)

Surface Mount
Mixer
.05-2.5 GHz

AVANTEK

FEATURES

- **PlanarPak™ Surface Mount Package**
- **7 dB (Typical) Conversion Loss/Noise Figure**
- **30 dB (Typical) Port-to-Port Isolation**
- **Low VSWR At All Ports**


PP-38M Case
(p. 391)

ELECTRICAL SPECIFICATIONS[1,2]

Symbol	Characteristic	Operating Frequencies, GHz			Power Level			Specifications		Unit
		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range	0.05–3.0	0.05–2.5	0.001–1.5	+10 to +15	M				GHz
CL,NF	SSB Conversion Loss and Noise Figure	0.05–2.0	0.05–1.5	0.001–0.5				7.0	9.0	dB max
		0.05–3.0	0.05–1.5	0.5–1.5				7.2	9.0	
		0.05–3.0	1.5–2.5	0.001–0.5				7.4	10.0	
		0.05–3.0	1.5–2.5	0.5–1.5				7.6	10.0	
ISOL	Isolation Port-to-Port L-R	0.05–3.0	—	—				35	25	dB min
	L-I	0.05–3.0	—	—				35	25	
	R-I	0.05–3.0	0.05–2.5	0.001–1.5				33	25	
—	VSWR (50 ohm) L	0.05–2.0	—	—				1.5:1	2.5:1	max
	L	2.0–3.0	—	—				2.5:1	3.0:1	
	R	0.05–2.0	0.05–0.5	0.001–1.5				1.2:1	2.5:1	
	R	0.05–3.0	0.5–2.5	0.001–1.5				2.0:1	3.0:1	
	I	0.05–3.0	0.05–2.5	0.001–1.5				1.5:1	2.5:1	
CC	Conversion Compression Point (0.5 dB/1.0 dB)	0.05–2.0	0.05–1.5	0.001–0.5	> +10	M		5.0/6.0	1.5/3.0	dBm max
		0.05–2.0	0.05–1.5	0.5–1.5	≥ +10	M		4.0/5.5	0.5/2.0	
		0.05–3.0	0.05–2.5	0.001–1.5	≥ +10	M		3.0/4.5	−1.5/1.0	
IP_3	Third-Order Two-Tone Intercept Point	0.06	0.05	0.01				15		dBm typ
		0.11	0.10	0.01				16		
		0.30	0.25	0.05				18		
		0.60	0.50	0.10				22		
		1.10	1.00	0.10				15		
		2.50	2.00	0.50				13		
		3.00	2.50	0.50				13		

NOTE 1: Specifications apply in a 50 ohm system with LO input power of +10 dBm and RF input power of −10 dBm.
NOTE 2: Low frequency performance can be extended and/or enhanced through use of additional turns on LO, RF or IF transformers or by use of transformer material with higher relative permeability. Such modifications result in degradation of high frequency performance.

WEIGHT: (typical) 0.5 grams

TYPICAL PERFORMANCE AT 25°C

Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

5	>70	>70	>70	>70	>70
4	>70	>70	>70	>70	>70
3	65	>70	60	>70	65
2	55	45	55	58	55
1	0	35	18	45	30
	1	2	3	4	5

Harmonics of f_{LO}

Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers apply in a 50 ohm system with LO input power of +10 dBm and RF input power of −10 dBm.

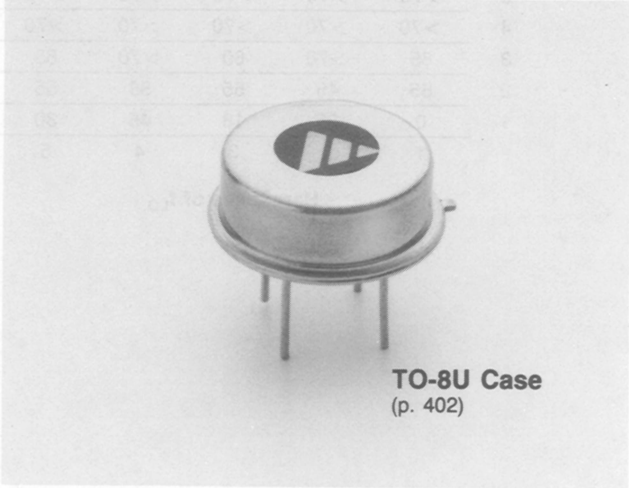
UMX-520

UMX Series
Double Balanced Mixer
1.0-500 MHz

AVANTEK

FEATURES

- **High Isolation**
- **Low VSWR**



TO-8U Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic	Operating Frequencies, MHz			Power Level			Specifications		Unit
		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range	1–500	1–500	DC–500						MHz
CL	SSB Conversion Loss	1–500	1–500	DC–500	+7			6.0	7.0	dB max
NF	SSB Noise Figure	1–500	1–500	0.1–500	+7			6.0	7.0	dB max
ISOL	Isolation Port-to-Port L-R	1–100	—	—				65	40	dB min
	L-R	100–500	—	—				50	40	
	L-I	1–100	—	—				50	35	
	L-I	100–500	—	—				45	30	
	R-I	—	1–100	—				40	25	
	R-I	—	100–500	—				25	20	
—	VSWR (50 ohm) L	1–500	—	—				1.5:1		max
	R	—	1–500	—				1.4:1		
	I	—	—	1–500				1.5:1		
CC	Conversion Compression Point	1–500	1–500	DC–500	+7		−2	1.0	—	dBm max
IP_3	Third-Order Two-Tone Input Intercept Point	1–100 100–500	1–100 100–500	DC–500 DC–500	+7 +7		— —	+12 +10	— —	dBm typ

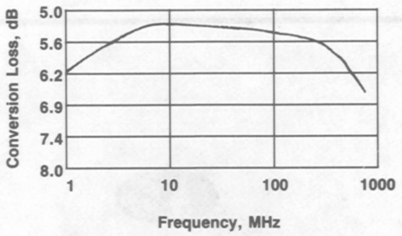
MAXIMUM RATINGS

Peak Input Current @ 25°C	100 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	−55°C to +100°C
Storage Temperature	−65°C to +100°C
Continuous RF Input Power	200 mW @ +25°C 100 mW @ +100°C

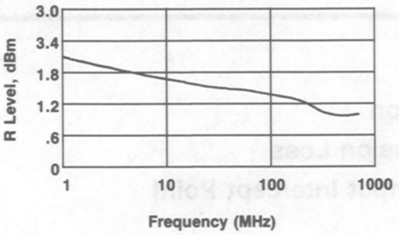
WEIGHT: (typical) 0.06 oz.

TYPICAL PERFORMANCE AT 25°C (measured in a 50-ohm system with LO = +7 dBm)

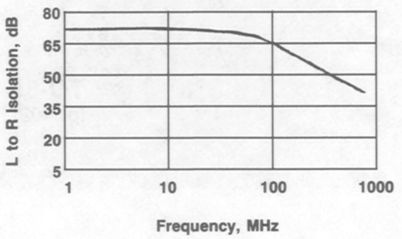
Conversion Loss vs. Frequency



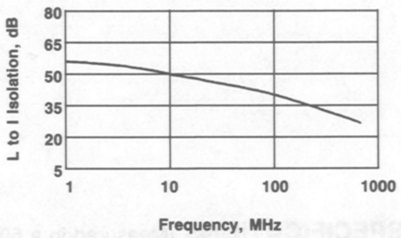
1 dB Conversion Compression vs. Frequency



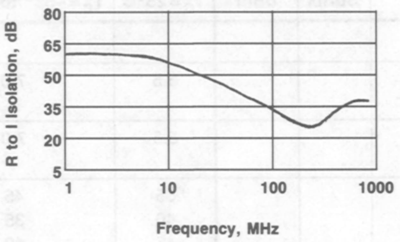
L Port — R Port Isolation vs. Frequency



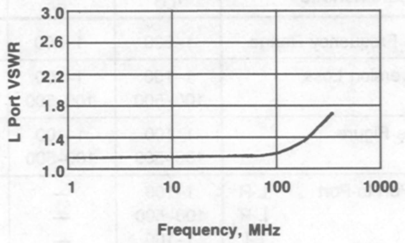
L Port — I Port Isolation vs. Frequency



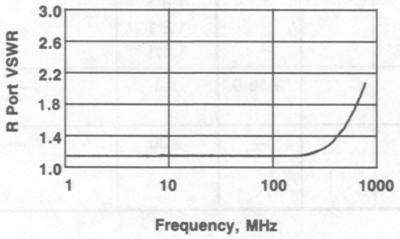
R Port — I Port Isolation vs. Frequency



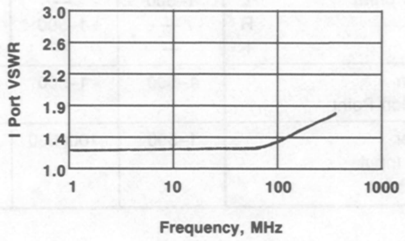
L Port VSWR vs. Frequency



R Port VSWR vs. Frequency



I Port VSWR vs. Frequency



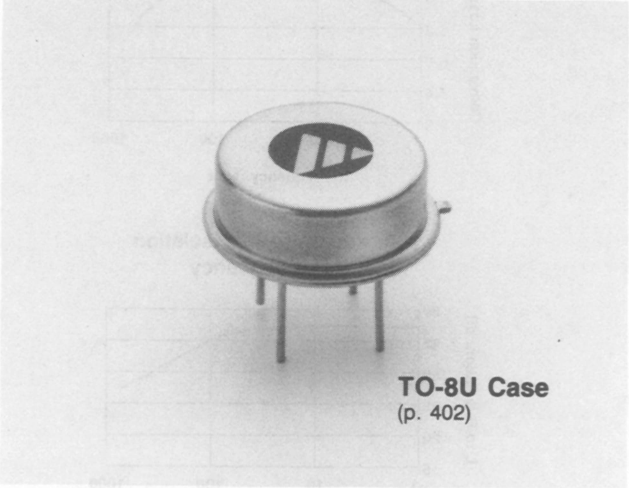
UMX-570

UMX Series
Double Balanced Mixer
1.0-500 MHz

AVANTEK

FEATURES

- **High Isolation**
- **Low Conversion Loss**
- **+34 dBm Input Intercept Point**



TO-8U Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic	Operating Frequencies, MHz			Power Level			Specifications		Unit
		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range	1–500	1–500	DC–500						MHz
CL	SSB Conversion Loss	1–100 100–500	1–100 100–500	DC–500 DC–500	+27 +27			5.5	7.0	dB max
NF	SSB Noise Figure	1–100 100–500	1–100 100–500	0.1–500 0.1–500	+27 +27			5.5	7.0	dB max
ISOL	Isolation Port-to-Port L-R	1–100	—	—				55	45	dB min
	L-R	100–500	—	—				40	35	
	L-I	1–100	—	—				45	40	
	L-I	100–500	—	—				35	30	
	R-I	—	1–100	—				40	30	
	R-I	—	100–500	—				25	20	
—	VSWR (50 ohm) L	1–500	—	—				1.8:1		max
	R	—	1–500	—				1.2:1		
	I	—	—	1–500				1.6:1		
CC	Conversion Compression Point	1–500	1–500	DC–500	+27		+18.0	1.0	—	dBm max
IP_3	Third-Order Two-Tone Input Intercept Point	1–500	100–500	DC–500	+27		—	+30	—	dBm typ

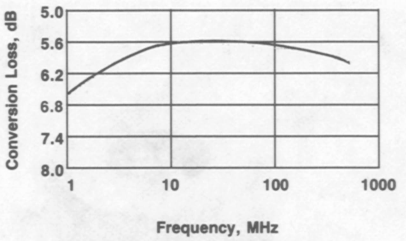
MAXIMUM RATINGS

Peak Input Current @ 25°C	200 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	–55°C to +100°C
Storage Temperature	–65°C to +100°C
Continuous RF Input Power	1 W @ +25°C 500 mW @ +100°C

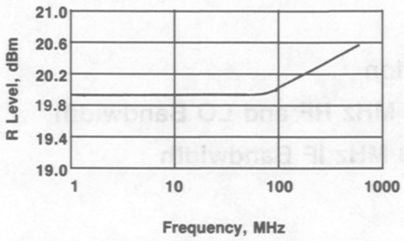
WEIGHT: (typical) 0.06 oz.

TYPICAL PERFORMANCE AT 25°C (measured in a 50-ohm system with LO = +27 dBm)

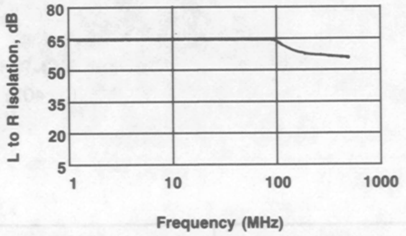
Conversion Loss vs. Frequency



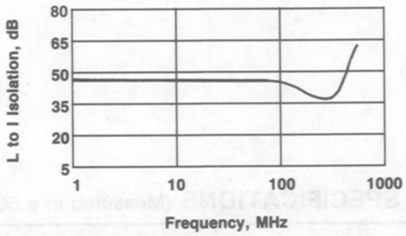
1 dB Conversion Compression vs. Frequency



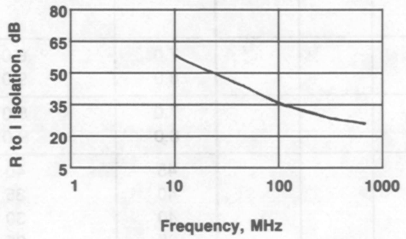
L Port — R Port Isolation vs. Frequency



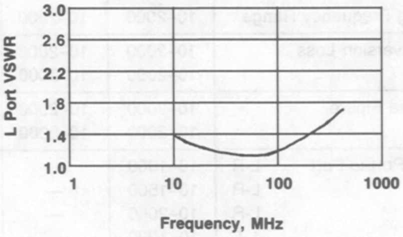
L Port — I Port Isolation vs. Frequency



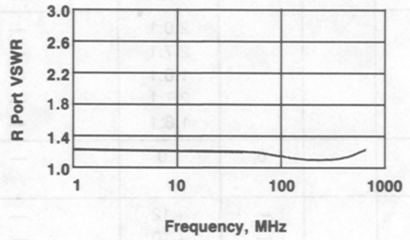
R Port — I Port Isolation vs. Frequency



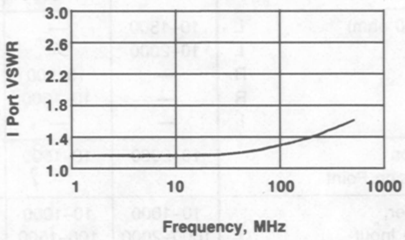
L Port VSWR vs. Frequency



R Port VSWR vs. Frequency



I Port VSWR vs. Frequency



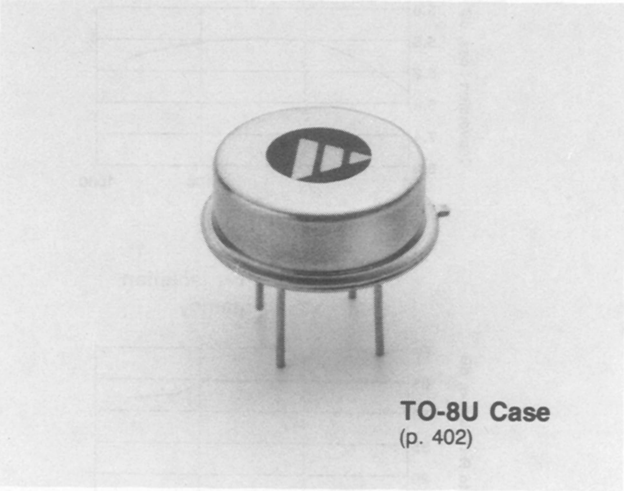
UMX-2020

UMX Series
Double Balanced Mixer
10.0-2000 MHz

AVANTEK

FEATURES

- **High Isolation**
- **10 to 2000 MHz RF and LO Bandwidth**
- **DC to 1000 MHz IF Bandwidth**



TO-8U Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

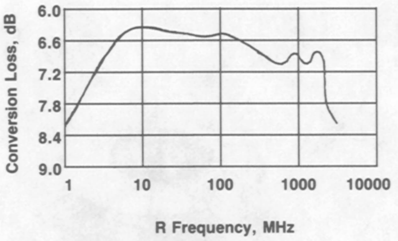
Symbol	Characteristic		Operating Frequencies, MHz			Power Level			Specifications		Unit
			f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range		10–2000	10–2000	DC–1000						MHz
CL	SSB Conversion Loss		10–2000	10–2000	DC–500	+7			7.0	8.0	dB max
			10–2000	10–2000	DC–1000				8.0	9.0	
NF	SSB Noise Figure		10–2000	10–2000	0.1–500	+7			7.0	8.0	dB max
			10–2000	10–2000	0.1–1000				8.0	9.0	
ISOL	Isolation Port-to-Port	L-R	10–1000	—	—				45	40	dB min
		L-R	10–1500	—	—				40	35	
		L-R	10–2000	—	—				40	30	
		L-I	10–1000	—	—				35	25	
		L-I	10–1500	—	—				30	20	
		L-I	10–2000	—	—				25	15	
		R-I	—	10–1000	—				20	20	
		R-I	—	10–2000	—				16	17	
—	VSWR (50 ohm)	L	10–1500	—	—				2.0:1	—	max
		L	10–2000	—	—				2.7:1	—	
		R	—	10–500	—				1.6:1	—	
		R	—	10–1500	—				2.7:1	—	
		I	—	—	10–1000				1.6:1	—	
CC	Conversion Compression Point		10–2000	10–1500	DC–1500	+7		0	1.0	—	dBm max
IP_3	Third-Order, Two-Tone Input Intercept Point		10–1000	10–1000	DC–1500	+7		—	+12	—	dBm typ
			1000–2000	100–1500	DC–1500	+7		—	+10	—	

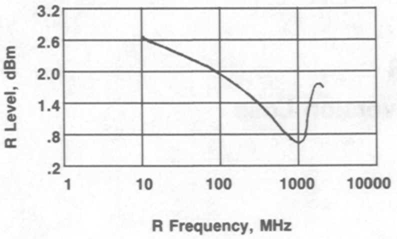
MAXIMUM RATINGS

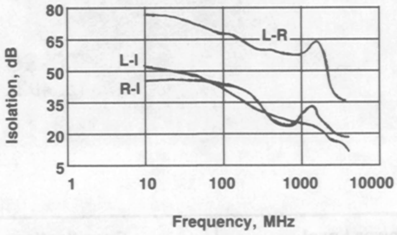
Peak Input Current @ 25°C	100 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	−55°C to +100°C
Storage Temperature	−65°C to +100°C
Continuous RF Input Power	200 mW @ +25°C 100 mW @ +100°C

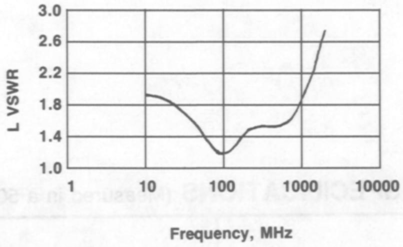
WEIGHT: (typical) 0.06 oz.

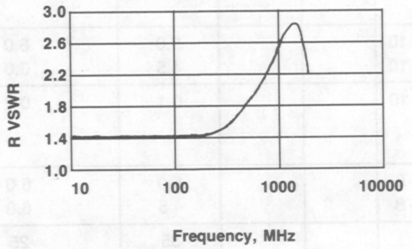
TYPICAL PERFORMANCE AT 25°C (measured in a 50-ohm system with LO = +7 dBm and IF = 100 MHz)

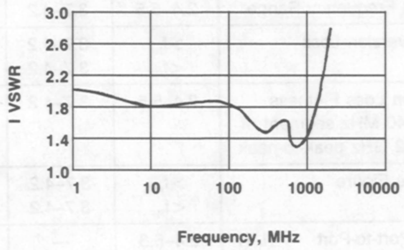

Conversion Loss


1 dB Conversion Compression


Isolation


LO VSWR


RF VSWR


IF VSWR

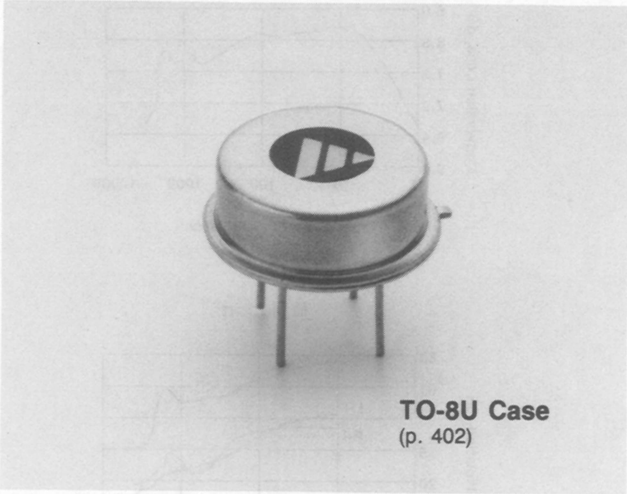
UMX-4220

UMX Series
Double Balanced Mixer
3700-4200 MHz

AVANTEK

FEATURES

- **1.5:1 VSWR**
- **4.5 dB Conversion Loss**
- **Low Cost**



TO-8U Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic	Operating Frequencies, GHz			Power Level			Specifications		Unit
		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range	2.4–5.5	3.7–4.2	DC–1.3						GHz
CL	SSB Conversion Loss	$>f_{RF}$ $<f_{RF}$	3.7–4.2 3.7–4.2	DC–1.3 DC–1.3	+7 to +10 +7 to +10			5.0 4.5	6.0 6.0	dB max
—	Conversion Loss Flatness over any 40 MHz segment of f_{RF} 3.7–4.2 GHz peak-to-peak	2.4–5.5	3.7–4.2	DC–1.3	+7 to +10			0.1	0.2	dB max
NF	SSB Noise Figure	$>f_{RF}$ $<f_{RF}$	3.7–4.2 3.7–4.2	0.03–1.3 0.03–1.3	+6 to +8 +6 to +8			5.0 4.5	6.0 6.0	dB max
ISOL	Isolation Port-to-Port L-R R-L R-I L-I	2.4–5.5 — — 2.4–5.5	— 3.7–4.2 3.7–4.2 —	— — — —				35 35 20 25	25 — — 20	dB min
—	VSWR (50 ohm) L R I	2.4–5.5 — —	— 3.7–4.2 —	— — 0.01–1.3				1.5:1 1.5:1 1.5:1		max
CC	Conversion Compression Point	2.4–5.5	3.7–4.2	≤1.3	≥ +7		+1	0.5	1.0	dBm max
IP_3	Third-Order, Two-Tone Input Intercept Point	2.4–5.5	3.7–4.2	≤1.3	≥ +7		—	+12	—	dBm typ

MAXIMUM RATINGS

Peak Input Current @ 25°C	100 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	−55°C to +100°C
Storage Temperature	−65°C to +100°C
Continuous RF Input Power	200 mW @ +25°C 100 mW @ +100°C

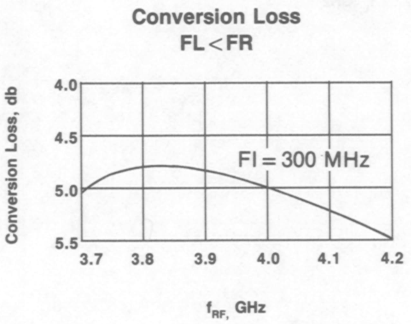
WEIGHT: (typical) 0.06 oz.

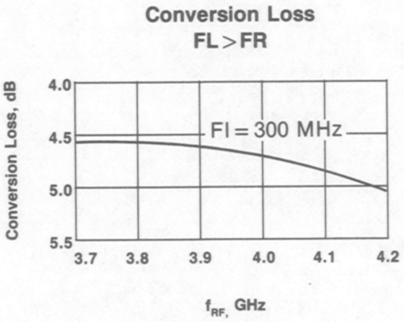
TYPICAL PERFORMANCE AT 25°C

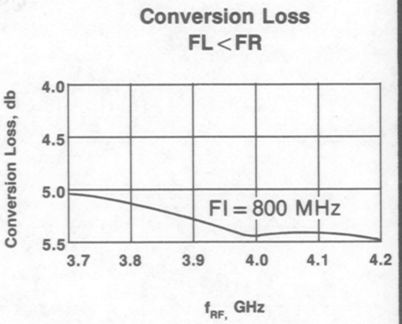
Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

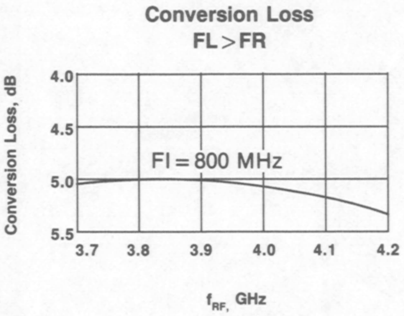
Harmonics of f_{RF} \ Harmonics of f_{LO}	1	2	3	4
4	>70	>70	>70	>70
3	65	>70	55	>70
2	50	55	50	58
1	0	25	18	40

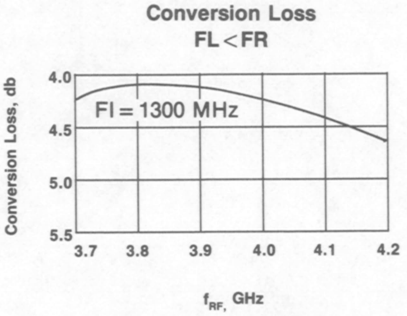
Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at – 10 dBm and f_{LO} signal level of + 7 dBm.

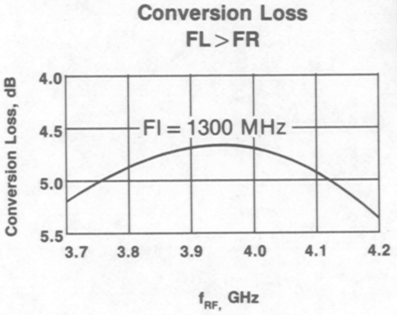

Conversion Loss
FL<FR

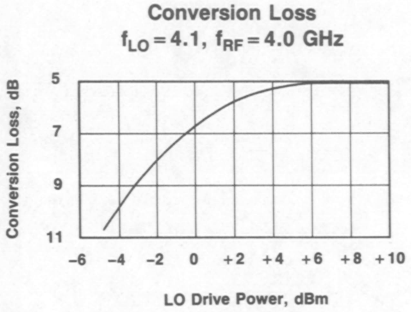

Conversion Loss
FL>FR

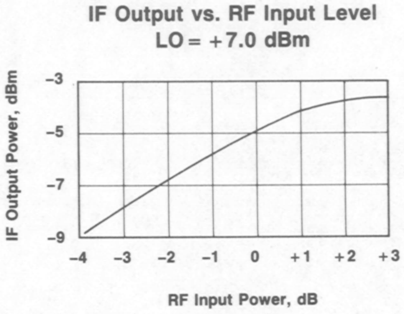

Conversion Loss
FL<FR

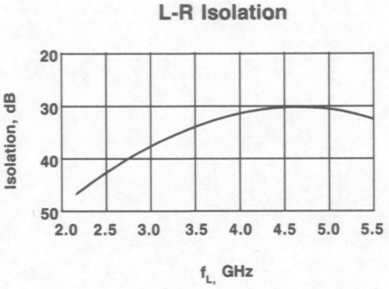

Conversion Loss
FL>FR

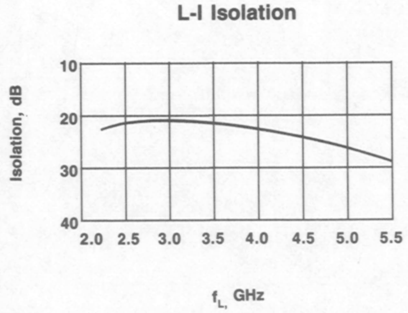

Conversion Loss
FL<FR

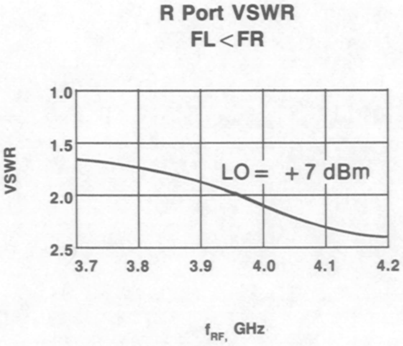

Conversion Loss
FL>FR

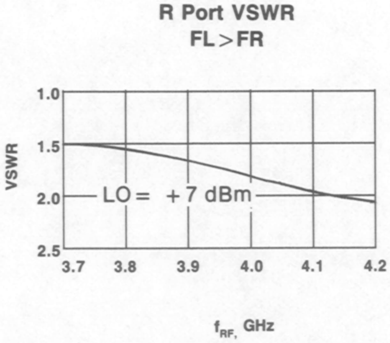

Conversion Loss
f_{LO} = 4.1, f_{RF} = 4.0 GHz


IF Output vs. RF Input Level
LO = +7.0 dBm

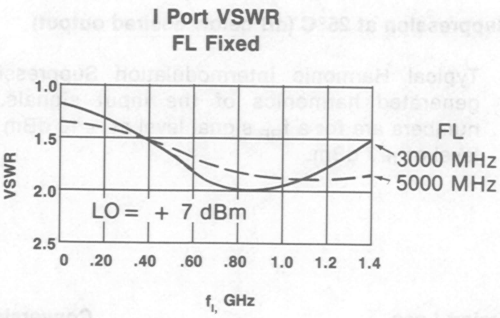

L-R Isolation

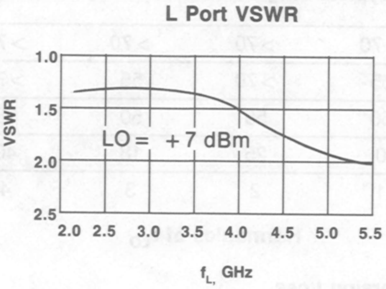

L-I Isolation


R Port VSWR
FL<FR


R Port VSWR
FL>FR

TYPICAL PERFORMANCE AT 25°C (continued)


I Port VSWR
FL Fixed


L Port VSWR

NOTES:

Application Notes

Avanpak™ Double Balanced Mixers

The Avanpak™ microwave mixer line covers the frequency range 2.0 to 26.0 GHz with various IF response frequencies ranging from DC to 12.0 GHz. All mixers feature high isolation, relatively low conversion loss and a good 50-ohm match (low VSWR) at all ports so they can be easily integrated with other RF components.

DBX/DBY Series mixers use precisely matched Schottky-barrier diodes and a "quasi-planar" physical construction for excellent overall symmetry. Construction techniques result in high LO to RF isolation, extremely low single tone intermodulation distortion and very good amplitude and phase match characteristics.

The multi-octave frequency coverage of Avantek microwave mixers make them ideal in threat warning self protection jammer and wideband heterodyned receiver applications. For example, the DC to 6.0 GHz IF response of the model DBX/DBY-185 allows 4.0 GHz "chunks" of the RF spectrum from 5.0 to 18.0 GHZ to be instantaneously folded down into the 2.0 to 6.0 GHz IF band with a fixed LO frequency. Conversely an extremely wideband 100 kHz to 6.0 GHz low frequency band may be upconverted to a single RF frequency for simple downconversion.

The DBX/DBY Series of microwave mixers work equally well in narrowband low IF frequency applications. With a conversion loss less than 6.0 dB, L to R isolation of 35 dB and an R Port VSWR of less than 2.0:1 they truly are universal, i.e. provide premium performance at narrowband while covering multi-octave bandwidths.

Note: All Avanpak mixers are available in both DBX- and DBY- prefix versions. The DBY verison is physically smaller for more compact stripline/microstrip systems, yet offers all the performance and reliability features of the DBX package.

UNIQUE FEATURES OF THE DBX/DBY SERIES INCLUDE:

1. *Operation with only +7 dBm LO drive level.* Unlike most multi-octave mixers, the Avanpak™ mixers, with the exception of the 18212/1824/824 Series, utilize a single Schottky diode-quad rather than two diode quads. Mixers having an "L" suffix require only +7 dBm rather than the +10 dBm LO drive level that most multi-octave mixers require.
2. *High isolation over multi-octave bands.* With 30 to 35 dB of L to R isolation, these mixers provide very high isolation of the LO signal and minimize the LO leakage to the antenna.
3. *Superior single tone intermodulation suppression.* The mixers are fabricated in a very symmetrical configuration combining the suspended substrate technique with a new "quasi planar" layout. This combination insures best possible balance of the mixer and best suppression of harmonic related intermodulation products. Typical $2f_{LO} \pm 2f_{RF}$ suppression of the DBX/DBY Series mixers relative to the desired output is >55 dB with an RF input level of −10.0 dBm. In instantaneous band folding applications where the IF band is 2.0 to 6.0 GHz and intermodulation products limit the dynamic range of the receiver, maximum suppression is very important.
4. *Low conversion loss at high IF frequency.* In applications where preamplifiers can not be used because of dynamic range limitations, the conversion loss of the first mixer becomes a heavy contributor to the system noise figure. Under a "worst case" frequency condition of 18.0 GHz RF and 6.0 GHz IF the model DBX/DBY-185 has less than 8.0 dB conversion loss.
5. *Flat IF response.* The Avantek model DBX/DBY-185 has an IF flatness of less than ±0.5 dB across 2.0 to 6.0 GHz. The Avantek model DBX/DBY-184 has an IF flatness of less than ±.25 dB across 2.0 to 4.0 GHz.
6. *Low VSWR.* The R-Port VSWR of the model DBX/DBY-185 is typically less than 1.3:1 at 18.0 GHz and the L-Port is typically less than 2.0:1 across the 5.0 to 18.0 GHz band. For the systems designer the low VSWR of the DBX/DBY series of mixers means less buffering with amplifiers, isolators or reistive pads to reduce interaction between the mixer and the local oscillator, switch or filter.
7. *Smallest Size.* Each mixer is packaged in the hermetically-sealed Avanpak with field replaceable connectors. The DBY package measures only 0.80 × 0.66 × 0.22 or less than 0.11 cubic inches. The DBX package measures 0.96 × 0.66 × 0.22 or 0.14 cubic inches. Mounting holes through the frame of the package allow the user to ground the mixer directly to the ground plane without use of a hold-down plate.

Three versions of the basic mixers are available; requiring nominal local oscillator drive levels, and providing two-tone, third-order input intercept points as follows:

L-suffix: . . . . **+10 dBm LO drive,**
+15 dBm intercept point

M-suffix . . . . **+13 dBm LO drive,**
+20 dBm intercept point

H-suffix . . . . **+20 dBm LO drive,**
+25 dBm intercept point

DBX/DBY MIXER SELECTION CHART

Model	Operating Frequencies		Typical 0.5 dB Input Comp. Pt. w Min. LO Drive Level	Minimum LO Drive Level	Typcial Input Intercept Point	Assoc. LO Power	Page	Recommended Application
DBX/DBY	FR & FLO (GHz)	FI (GHz)	(dBm)	(dBm)	(dBm)	(dBm)		
72L	2.0–7.0	DC–1.3	+4	+7	+15	+10	256	In 2.0 to 7.0 GHz applications with low IF. Ideal for 2.0 to 6.0 GHz, and 3.7 to 4.2 GHz down conversion.
72M	2.0–7.0	DC–1.3	+4	+10	+20	+13		
72H	2.0–7.0	DC–1.3	+10	+17	+25	+20		
1221L	2.0–12.0	DC–1.3	+4	+7	+15	+10	278	In 2.0 to 12.0 GHz applications. Ideal for 2.0 to 8.0 GHz down conversion or 5.9 to 6.4 GHz conversion applications.
1221M	2.0–12.0	DC–1.3	+5	+10	+20	+13		
1221H	2.0–12.0	DC–1.3	+10	+17	+25	+20		
158L	8.0–15.0	DC–1.0	+4	+7	+15	+10	258	In 8.0 to 15.0 GHz applications. Will work well as low-cost 11.7 to 12.2 GHz down converter.
158M	8.0–15.0	DC–1.0	+5	+10	+20	+13		
158H	8.0–15.0	DC–1.0	+10	+17	+25	+20		
167L	7.0–16.0	DC–4.0	+4	+7	+15	+10	260	In 7.0 to 16.0 GHz "band folding" applications. Ideal in narrow band applications where cost is more important than bandwidth,
167M	7.0–16.0	DC–4.0	+5	+10	+20	+13		
167H	7.0–16.0	DC–4.0	+10	+17	+25	+20		
184LS	4.0–18.0	DC–1.5	+4	+7	+15	+10	266	In 4.0 to 18.0 GHz swept frequency applications. Has been optimized for increased L to I isolation.
184MS	4.0–18.0	DC–1.5	+5	+10	+20	+13		
184HS	4.0–18.0	DC–1.5	+10	+17	+25	+20		
184L	4.0–18.0	DC–4.0	+4	+7	+15	+10	264	In 4.0 to 18.0 GHz band folding applications where the IF band is greater than 1.5 GHz.
184M	4.0–18.0	DC–4.0	+5	+10	+20	+13		
184H	4.0–18.0	DC–4.0	+10	+17	+25	+20		
185L	5.0–18.0	DC–6.0	+4	+7	+15	+10	268	In 5.0 to 18.0 GHz band applications that require a 2.0 to 6.0 GHz IF response.
185M	5.0–18.0	DC–6.0	+5	+10	+20	+13		
185H	5.0–18.0	DC–6.0	+10	+17	+25	+20		
186L	6.0–18.0	DC–7.0	+4	+7	+15	+10	270	In 6.0 to 18.0 GHz band folding applications that require a 2.0 to 7.0 GHz IF response.
186M	6.0–18.0	DC–7.0	+5	+10	+20	+13		
186H	6.0–18.0	DC–7.0	+10	+17	+25	+20		
1824M	2.0–18.0	.005–4.0	+7	+10	+20	+13	280	In 2.0 to 18.0 GHz swept frequency applications where the IF frequency is less than 4.0 GHz.
1824H	2.0–18.0	.005–4.0	+8	+13	+22	+17		
18212M	2.0–26.0 (LO) 2.0–18.0 (RF)	1.0–12.0	+7	+10	+20	+13	286	In 2.0 to 18.0 GHz band folding or 1.0 to 12.0 GHz up-converting applications where a high IF frequency is required.
18212H	2.0–26.0 (LO) 2.0–18.0 (RF)	1.0–12.0	+8	+13	+22	+17		
824M	2.0–8.0	.005–4.0	+7	+10	+20	+13	274	In up-conversion applications where wide low frequency bands of 0.1 to 2.0 GHz need to be converted into a common IF band such as 2.0 to 4.0 GHz or 2.0 to 6.0 GHz.
824H	2.0–8.0	.005–4.0	+8	+13	+22	+17		

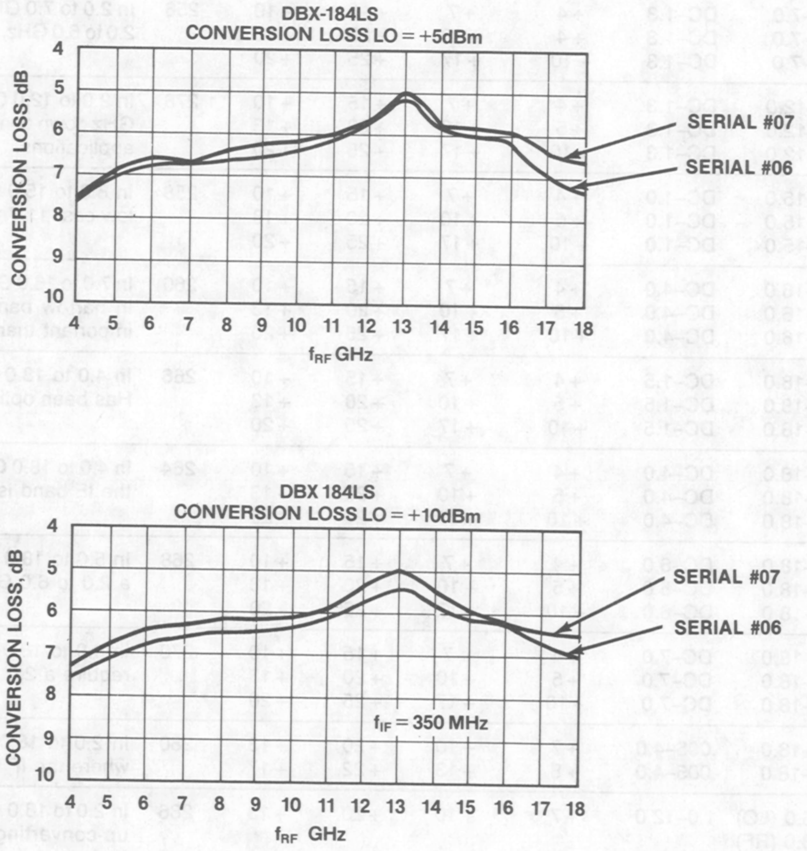
REQUIRED MIXER LO LEVEL CHART

Type of Mixer	Mixer Models	LO Operating Power Level	Typical 0.5 dB Input Compression Point	Typical Input Intercept Point
Low Level	All "L" suffix mixers	+7 to +13 dBm	+1 dBm w +7 dBm LO power	+8 dBm w +10 dBm LO power
Moderate Level	All "M" suffix mixers	+10 to +17 dBm	+5 dBm w +10 dBm LO power	+12 dBm w +17 dBm LO power
High Level	All "H" suffix mixers	+17 to +24 dBm	+10 dBm w +17 dBm LO power	+22 dBm w +20 dBm LO power
Moderate Level	18212M 1824M–824M	+10 to +17 dBm	+7 dBm w +10 dBm LO power	+15 dBm w +13 dBm LO power
High Level	18212H 1824H–824H	+13 to +20 dBm	+8 dBm w +13 dBm LO power	+25 dBm w +17 dBm LO power

EXCELLENT AMPLITUDE AND PHASE MATCH

The quasi-planar circuit used in the DBX/DBY Series microwave mixers assures that all mixers will have similar performance characteristics. Evidence of this repeatability and consistency is shown in the 4.0 to 18.0 GHz conversion loss plot (fig. 1) for two randomly-selected DBX-184LS mixers. Note that below 16 GHz, the amplitude match is within 0.2 dB, and at 18 GHz the amplitude deviation is within 1.0 dB with a +5 dBm LO drive level, within 0.4 dB with a +10 dBm LO drive.

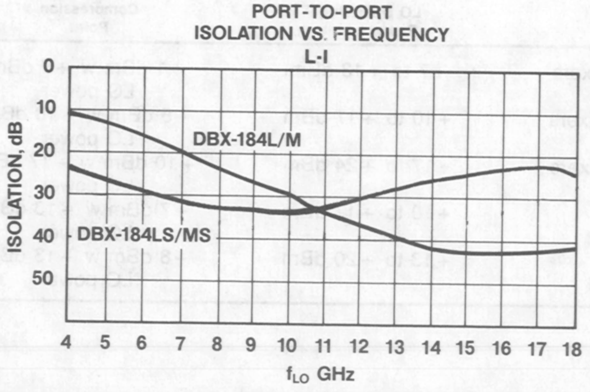
Figure 1



IMPROVED LO TO IF ISOLATION

The DBX/DBY-158/-167/-184/-185/-186 Series of microwave mixers has a wide IF frequency response and consequently the LO-to-IF isolation is not particularly high compared to other DBX/DBY Series mixers in the lower half of the LO frequency range. In band-folding applications where a high-side, fixed-frequency LO drive signal is used, LO-to-IF isolation is normally not important at the lower frequencies. In swept-frequency applications, where LO leakage to the IF port could cause output ripple due to the resulting LO signal mismiatch at the port, the DBX-184LS/184MS mixer is recommmended. This mixer incorporates a low-pass filter in the IF port to improve the LO-to-IF isolation by as much as 15 dB at the lower LO frequencies.

Figure 2



BEST INTERMODULATION SUPPRESSION

In applications where the internally-generated harmonic of a mixer limits dynamic range, a low-level mixer (L suffix) is recommended. The best suppression is generally obtained with + 7 dBm LO drive level, although there will be an optimum LO drive for each harmonic product. At times, an improvement in supression of a particular harmonic product may be obtained by reversing the LO and RF signal inputs (i.e., by feeding the high-level LO drive signal into the RF port) to the mixer.

Figure 3 shows typical single-tone intermodulation suppression for DBX/DBY Series mixers with single diode quad design. LO input levels are + 7 dBm for "L"-suffix versions and + 10 dBm for "M"-suffix versions, RF input level is − 10 dBm. The suppression numbers represent dB below the desired output of $f_{LO} \pm f_{RF}$.

Figure 4 shows typical single-tone intermodulation suppression for DBX/DBY Series mixer with dual quad design.

Figure 3

Intermodulation Supression for Single Quad Mixer

Harmonics of f_{RF}	1	2	3	4
4	—	—	>70	>70
3	—	>70	55	>70
2	50	55	50	—
1	—	25	—	—

Harmonics of f_{LO}

Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at −10 dBm and f_{LO} signal level of +7 dBm for "L" suffix and +10 dBm for "M" suffix mixers.

Figure 4

Intermodulation Suppression for DBX/DBY 1824/18212 Dual Quad Mixer

Harmonics of f_{RF}	1	2	3	4	5	6
6	>70	>70	>70	>70	>70	>70
5	>70	>70	>70	>70	>70	>70
4	>70	>70	>70	>70	>70	>70
3	65	>70	60	>70	65	>70
2	55	55	55	58	55	60
1	0	35	18	40	35	45

Harmonics of f_{LO}

Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level of −10 dBm and f_{LO} signal level of +10 dBm for "M" suffix and +13 dBm for "H" suffix mixers.

BEST TWO-TONE SUPPRESSION

For best two-tone $(2 f_{R2} - f_{R1}) + f_{LO}$ suppression, a high level mixer is recommended. However to obtain best performance, a high LO drive level must be available for the mixer as indicated in the recommended LO drive level chart.

A high LO drive level raises the RF compression point and the third-order intercept point, but also results in higher LO leakage for a given isolation value and reduces harmonic intermodulation suppression.

Figure 5 shows conversion loss vs. LO drive level for the "L" and "M" suffix mixers. The minimum recommended LO drive level of + 7 dBm and + 10 dBm, respectively, is approximately 4 dB above the level where the conversion loss is degraded by insufficient drive.

Figure 6 shows conversion loss and input compression as a function of LO power. Generally the input intercept point of a mixer is 9 to 11 dB higher than the 1 dB input compression point for a given LO drive level. Note that by increasing the LO drive level from + 7 dBm to + 10 dBm the 1 dB compression point can be raised approximately 1.5 dB.

Figure 5

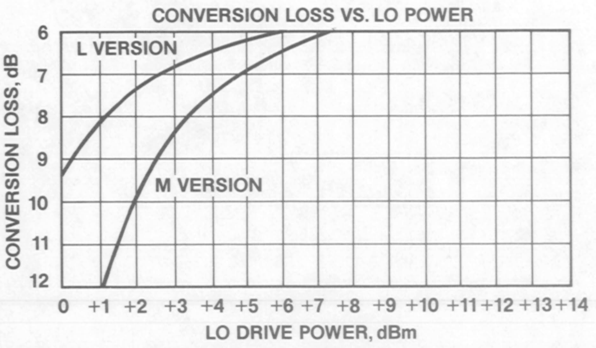
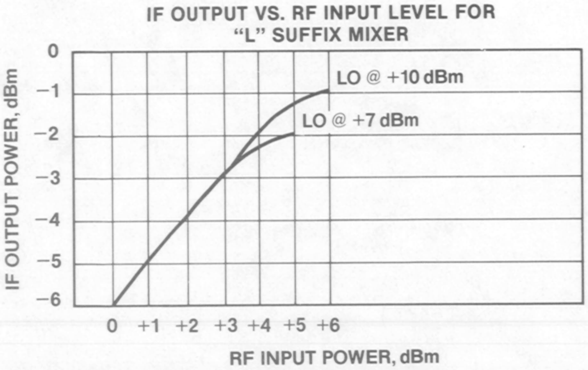


Figure 6



DESIGN AND CONSTRUCTION ASSURE CONSISTENT PERFORMANCE

Most of the Avantek DBX/DBY Series of double-balanced mixers incorporate four carefully matched and qualified (low or medium turn on depending on the model) diodes in a conventional ring configuration, with DC-coupled IF port. The H high level mixer incorporates eight diodes in a well matched diode quad to obtain high level performance. The 2 to 18 GHz mixer incorporates a dual quad configuration.

The transmission lines for each mixer is fabricated in flexible, low-dielectric substrate material—and built in a symmetrical configuration combining the suspended substrate technique with an unusual "quasi planar" layout. It is this combination of well-matched diodes and properly designed four-port hybrid junctions with a highly symmetrical structure that gives these "conventional" double-balanced mixers their unconventionally good performance.

ENVIRONMENTAL PERFORMANCE

The DBX/DBY Series of microwave mixers have been designed and built to meet their guaranteed performance specifications over the −54° to +100°C operating temperature range and after exposure to any or all of the following tests performed in accordance with MIL-STD-202:

Exposure	Method	Test Condition
Thermal Shock	107	B
Altitude	105	B
H.F. Vibration	204	D
Mechanical Shock	213	C
Random Vibration (15 minutes per axis)	214	IIF
Solderability	208	
Terminal Strength	211	C
Resistance to Soldering Heat	210	B
Seal Test	112	2×10^{-7} cc/sec

These mixers are uniquely suited for application in satellite or other systems calling for high-MTBF microwave components.

Application Notes

DBX-3503M/H

DESCRIPTION

The Avantek® DBX-3503M/H is a double-double-balanced mixer offering excellent performance over multi-octave RF, LO and IF Bandwidths—and is packaged in the unique Avanpak™ miniature hermetic case for application in microstripline or coaxial-interfaced systems.

This mixer uses precisely matched Schottky-barrier diodes and a blending of lumped and distributed circuit elements for excellent overall symmetry assuring at least 24 dB LO-RF isolation and low single tone intermodulation distortion.

A high performance triple balanced design permits overlapping RF, LO and IF frequency ranges with greater than 26 dB RF-IF isolation and IF bandwidths up to 3 GHz with very flat conversion loss.

Avantek DBX Series double-double-balanced mixers are also designed to assure a good 50 ohm match at all ports to simplify the design of the systems in which they are used.

APPLICATIONS

The DBX-3503M/H is particularly suitable for use as a first or second downconverter in a wideband super-heterodyne receiving system. Since the excellent performance of the DBX-3503 is maintained across the full RF and IF bandwidth, this mixer is ideal for many other applications, including:

- Frequency Upconverters
- DSB suppressed-carrier modulators
- VHF, UHF, L and S band block conversions
- Wideband Test Instrumentation

DESIGN AND CONSTRUCTION ASSURE CONSISTENT PERFORMANCE

Avantek DBX Series double-balanced mixers incorporate carefully matched and qualified diodes in a conventional ring configuration. The mixer is fabricated on flexible, low-dielectric substrate material—and built in a symmetrical configuration combining the suspended substrate technique. It is this combination of well-matched diodes and properly designed four-port hybrid junctions with a highly symmetrical structure that gives these "conventional" double-balanced mixers their unconventionally good performance.

AVANPAK PACKAGING—FLEXIBILITY, RELIABILITY AND OPTIMUM PERFORMANCE

All DBX Series mixers are supplied in the unique Avanpak miniature package—the ultimate product of Avantek's understanding the needs of the microwave community. As with all packages used in the Avantek thin-film hybrid product (MIC) line, the Avanpak package is truly hermetic. The lids are welded in place, all RF and DC connections are made through matched metal-glass feedthroughs, the package is filled with a dry, inert atmosphere and the complete assembly is both gross- and fine-leak tested to assure long-term protection of the internal circuitry from moisture and corrosive gasses.

Specifically, the Avanpak package is machined from stainless steel and passivated, and connections are made through plated pins which are captured in stress-relieved, constant-impedance glass feedthroughs. The circuits are attached directly to the case, eliminating the internal screws or other fasteners which are commonly used in MIC packaging. Thus, the basic assembly is extremely resistant to shock, vibration annd thermal cycling stress while assuring excellent RF performance.

The Avanpak package may be installed directly in a 50-ohm microstrip or stripline environment by soldering to the pins. It is equipped with numerous, conveniently located through-holes so it can be quickly and easily screwed to a supporting structure to prevent any strain on the microstripline PC board and assure good RF grounding.

In addition, special type SMA (male or female) connectors may be installed directly on the Avanpak package, simply by fitting their "internal" collets over the pins of the package and bolting the connectors to the threaded mounting holes (a simple bottom spacer plate is provided to assure connector clearance). These connectors are very simple and inexpensive, since hermeticity is provided by the Avanpak package itself.

This unique Avantek Avanpak package offers the ultimate in flexibility to the microwave system engineer. It can be used in coaxial-interconnected systems—and note that the connectors are *field replaceable!* It can be tested with the connectors in place, then the connectors removed for installation into the microstripline system. And, a complete system can be developed and tested in coaxial-interconnected form for later integration using exactly the same Avanpak package components.

Other Avantek components such as GaAs FET amplifiers are or will soon become available in the extraordinary Avanpak microwave package.

ENVIRONMENTAL PERFORMANCE

The DBX-3503M microwave mixer has been designed and built to meet the guaranteed performance specifications over the −54° to +100°C operating temperature range and after exposure to any of the following tests performed in accordance with MIL-STD-202E:

Exposure	Method	Test Condition
Temperature Cycle	102A	C
Thermal Shock	107D	B
Altitude	105C	G
H.F. Vibration	204C	D
Mechanical Shock	213B	C
Random Vibration (15 min. per axis)	214	IIF
Solderability	208C	
Terminal Strength	211A	C
Resistance to Soldering Heat	210A	
Seal Test	112	2×10^{-7} cc/sec

This mixer is uniquely suited for applications in satellite or other systems calling for high-MTBF microwave components.

Application Notes

MIXER-PREAMPLIFIERS

DESCRIPTION

The Avantek MXA Series of mixer-preamplifiers integrates Avantek's proven mixer and thin-film amplifier lines. These devices cover the frequency range from 0.05 to 18 GHz on the R and L ports with IFs up to 6 GHz. Virtually any combination of one standard Avantek DBX mixer with one AFT or one, two or three UTO thin-film amplifiers may be cascaded to meet customer needs. All combinations are packaged in Avanpak™ style cases to give the customer the advantages of small size, light weight and either coax, stripline or microstrip application.

MXA Series mixer-preamplifiers are standard devices, however, configurations can be tailored to meet particular customer needs such as amplification prior to, as well as after the mixer, or the incorporation of filters, couplers, detectors, switches or limiters with little or no increase in size. All products will operate over standard military temperature ranges and can be screened using MIL-STD-883 methods and procedures.

DESIGN FEATURES

The MXA Series of integrated mixer-preamplifiers feature premium performance for high density applications. For example, without sacrificing performance the MXA-18202 requires only 50% of the volume of a connectored Avanpak packaged mixer-amplifier combination. And when compared to conventionally packaged components, the space savings are much greater.

In addition to the reduced size, performance improvements result from the elimination of cabling between units. The MXA Series offers excellent broadband conversion gain flatness, typically less than ±1.5 dB over the 2 to 18 GHz frequency band. Units may be matched for conversion gain and phase to within very tight tolerances.

RELIABILITY

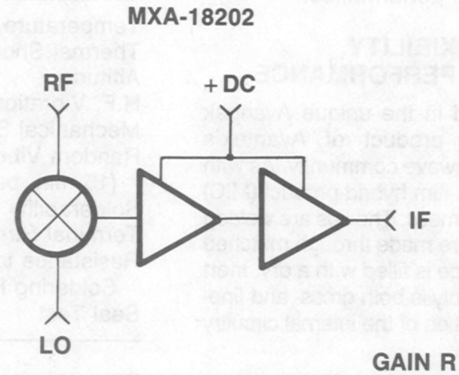
Avantek MXA Mixer-Preamplifiers are supplied in a unique Avanpak miniature package—the ultimate product of Avantek's understanding of the needs of the microwave community. As with all packages used in the Avantek thin-film hybrid product (MIC) line, the Avanpak is *truly hermetic*. The lids are welded in place, all RF and DC connections are made through matched metal-glass feedthroughs, the package is filled with a dry, inert atmosphere and the complete assembly is both gross- and fine-leak tested to assure long-term protection of the internal circuitry from moisture and corrosive gasses.

The Avanpak package may be installed directly in a 50-ohm microstrip of stripline environment by soldering to the pins. It is equipped with numerous, conveniently located through-holes so it can be quickly and easily screwed to a supporting structure to prevent any strain on the microstripline PC board and assure good RF grounding.

In addition, special type SMA (male or female) connectors may be installed directly on the Avanpak case, simply by fitting their "internal" collets over the pins of the package and bolting the connectors to the threaded mounting holes (a simple bottom spacer plate is provided to assure connector clearance). These connectors are very simple and inexpensive, since hermeticity is provided by the case itself.

This unique Avantek Avanpak package offers the ultimate in flexibility to the microwave system engineer. It can be used in coaxial-interconnected systems—and note that the connectors are *field replaceable!* It can be tested with the connectors in place, then the connectors removed for installation into the microstripline system. And, a complete system can be developed and tested in coaxial-interconnected form for later integration using exactly the same Avanpak components.

TYPICAL BLOCK DIAGRAM OF AN MXA SERIES MIXER-PREAMPLIFIER



RF 2.0–18.0 GHz
LO 2.0–18.0 GHz
IF 10–250 MHz

GAIN R TO I	**21 dB MIN**
NOISE FIGURE	**11 dB MAX**
POWER OUTPUT	**+9 dBm MIN**

Application Notes

UMX DOUBLE-BALANCED MIXERS

The UMX Series double-balanced mixers feature exceptionally high isolation and good harmonically-related intermodulation product suppression. They are packaged in compact, easy-to-use hermetically sealed TO-8 transistor packages.

The UMX-520 and UMX-2020 mixers cover 1 to 500 MHz and 10 to 2000 MHz respectively. Both are low-level class 1 type mixers with four closely matched Schottky-barrier diodes in a ring configuration. The LO to RF isolation of the UMX-2020 is typically greater than 60 dB from 10 to 150 MHz; greater than 50 dB from 150 to 500 MHz and greater than 40 dB from 500 to 2000 MHz.

The UMX-570 is a high level, class II type 1 mixer that utilizes eight closely matched Schottky-barrier diodes in a ring configuration. Since the diodes are a new, highly dissipative type diode, the UMX-570 can accept +27 dBm local oscillator power (rather than the typical +13 to +17 dBm) without the added complexity of series resistors (type 2) or resistor-capacitor combinations (Class III). The input third-order intercept point is greater than +34 dBm below 100 MHz and +32 dBm from 100 to 500 MHz. Along with very small size for a high level mixer, the UMX-570 is unique in that its conversion loss is only 5.0 to 6.0 dB. This conversion loss is 1.0 to 2.0 dB less than comparable high level mixers.

The Model UMX-4220 is a microwave mixer designed to meet the need for a low-cost high performance 3.7-4.2 GHz down-converter, mixer in TVRO applications. Typical conversion loss is 4.5 dB with a low-side LO frequency and 5.0 dB for a high-side LO frequency for either an 880 or 1125 MHz IF frequency. LO to RF isolation exceeds 30 dB.

To assure reliability in severe applications, the circuits are packaged in hermetically welded, inert gas filled metal-glass packages and leak tested.

As an additional assurance of reliability in critical applications. Avantek UMX Series mixers may be qualified under the ''R'' Series high reliability program. In addition to the normal careful design and in-process quality control, ''R'' Series qualified components include conditioning and testing in accordance with MIL-STD-883.

MIXERS: GLOSSARY OF TERMS

Mixer Ports: The input/output terminals of a mixer, are identified as RF, LO and IF. In most double balanced mixers, the LO and RF ports are either transformer or transmission line-coupled to the mixer diodes, and therefore have a limited low-frequency response while the IF port is usually direct-coupled with an essentially unlimited low frequency response. In upconverting applications, the low frequency input signal is often applied to the IF port with the higher-frequency output signal being taken from the RF port.

Mixing: The generation of sum and difference frequencies which result from applying two AC waveforms to a nonlinear circuit element. In mixer applications, with a signal of frequency f_{RF} applied to the RF port and a signal f_{LO} applied to the LO port, the resulting signal at the IF port will consist of two carriers (or sidebands) of frequencies $f_{RF}+f_{LO}$ and $f_{RF}-f_{LO}$ with internally-generated LO and RF harmonics.

Conversion Loss: The ratio (in dB) of the IF output power of a mixer to the RF input power. All conversion loss measurements and specifications are normally based on the mixer being installed in a system with wideband 50 ohm resistive terminations on all ports and a stated LO signal power level being applied.

SSB Conversion Loss: In most applications, only one of the signals $(f_{RF}+f_{LO})$ or $(f_{RF}-f_{LO})$ appearing at the IF port of a mixer is of interest, therefore only one of these signals (or sidebands) is considered when determining conversion loss. Single Sideband Conversion loss is 3 dB higher than the conversion loss when both sidebands are considered (Double Sideband Conversion Loss).

Drive Level: The power level of the local oscillator signal applied to the LO port of a mixer. Operating a mixer with the maximum recommended LO drive level will result in the best two-tone performance lowest conversion loss and flattest conversion loss vs. frequency characteristics. A reduced LO drive level may help reduce mixer-generated intermodulation products and minimize 1/f noise in the output signal. A higher-than recommended LO power level will result in an increased noise figure and higher LO feedthrough at both the RF and IF ports of the mixer.

Isolation: The ratio (in dB) of the power level applied at one port of a mixer to the resulting power level at the same frequency appearing at another port. Commonly specified isolation parameters of mixers are:

1. LO to RF port: The degree of attenuation of the LO signal measured at the RF port when the IF port is properly terminated.
2. LO to IF port: The degree of attenuation of the LO signal measured at the IF port with the RF port properly terminated.
3. RF to IF port: The degree of attenuation of the RF signal measured at the IF port with the LO port properly terminated.

Normally the inverse isolation characteristics (such as RF to LO, IF to LO and IF to RF) are essentially equivalent in a double balanced mixer.

Harmonic Intermodulation Distortion: The ratio (in dB) of distortion to the IF output waveform caused by mixer-generated harmonics of the RF and LO input signals. This characteristic is extremely dependent on input frequency, RF and LO signal levels and the precise impedance characteristics of all terminations at the operating frequency.

Dynamic Range: The range of RF input power levels over which a mixer can operate within the specified range of performance. The upper limit of the mixer dynamic range is controlled by the conversion compression point (also a function of LO drive level), and the lower limit is set by the mixer noise figure.

Conversion Compression Point (1 dB): The specification which states the RF input power (in dBm) at which the IF output power will increase only 9 dB for a 10 dB increase in RF input power at a stated LO input power level. Under normal operating conditions, with the RF input power level at least 10 dB below the LO input power level, the IF power output is a linear function of RF input minus conversion loss.

Conversion compression point provides an indication of the mixer two-tone intermodulation performance and is usually of most concern in high level mixing applications.

Intercept Point (3rd order): The theoretical point in dBm on the RF input vs. IF output curve at which the power levels of the desired IF output signal and third-order intermodulation products become equal. This parameter is highly dependent on the LO and RF frequency, the LO drive level, and the impedance characteristics of all terminations at the operating frequency.

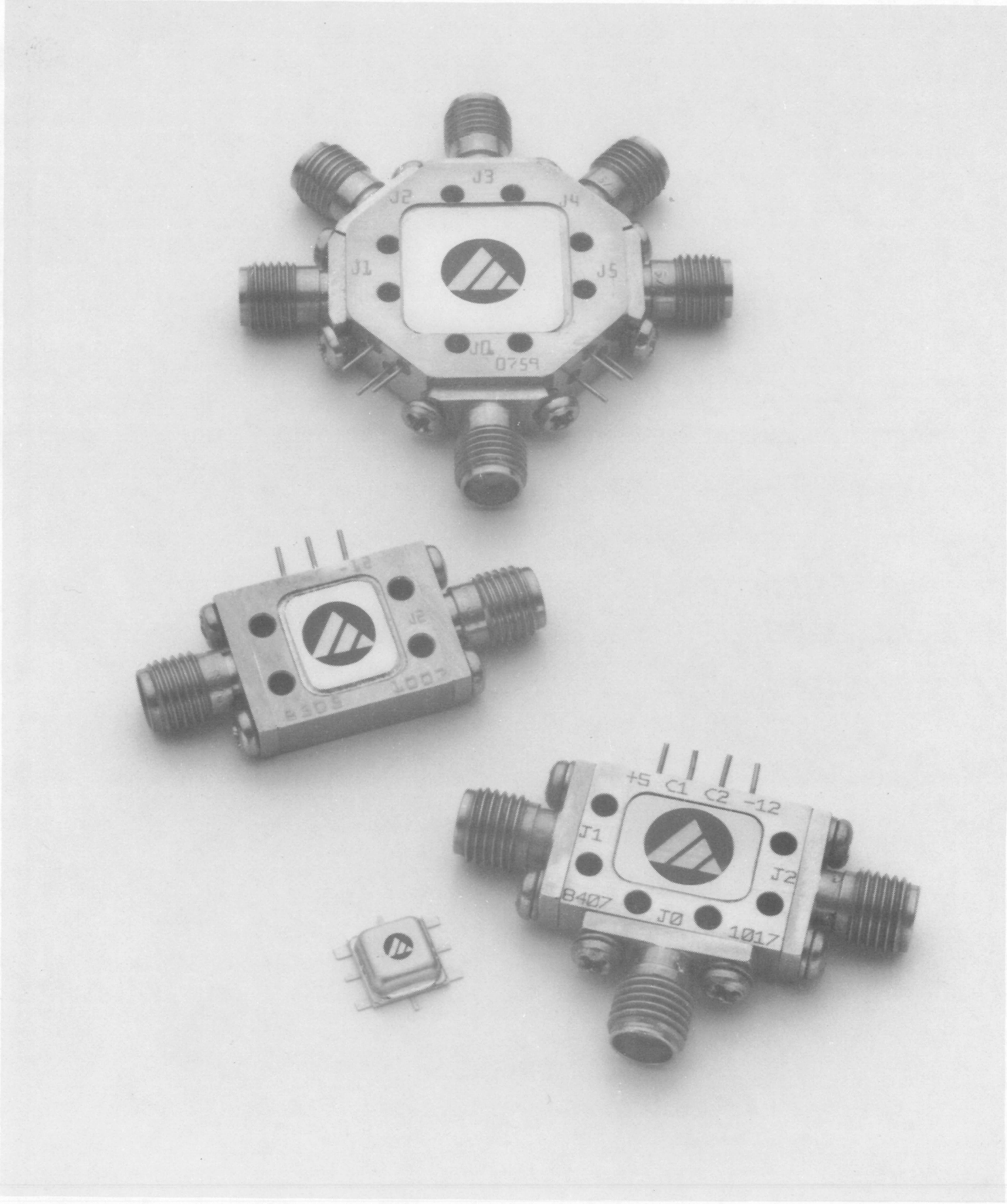
Two Tone, Third Order Intermodulation Distortion: The total amount of distortion (dB relative to desired waveform) to the output signal waveform that exists when two simultaneous input frequencies are applied to the RF port of a mixer. Two tone, third order intermodulation distortion products are described by $(2f_{R2}-f_{R1}) \pm f_{LO}$ and $(2f_{R1}-f_{R2}) \pm f_{LO}$. The higher the third-order intercept point and conversion compression points of a mixer, the lower will be the intermodulation for given input signal levels.

Cross Modulation Distortion: The amount of modulation impressed on an unmodulated carrier when a modulated signal is simultaneously applied to the RF port of a mixer under specified operating conditions. The tendency of a mixer to produce cross modulation is decreased with an increase in conversion compression point and intercept point.

Desensitization: The compression in the IF ouptut power from a desired RF input signal caused by a second high level signal being simultaneously applied to the RF port of a mixer. As a rule of thumb, in low level mixers, an undesired RF input 3 dB below the mixer conversion compression point will begin to cause desensitization.

NOTES:

PRODUCT DATA


J1
J2
J3
J4
J5
J0
0759
J2
1001
+5 C1 C2 -12
J1
J2
8407
J0
1017

• SWITCHES

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Application Notes 324

See Page 4 for a complete Alphanumeric Listing of Modular Products.

Product Descriptions

PIN-DIODE RF SWITCHES

The "AH" Series of pin-diode switches covers the full 2 to 18 GHz frequency range. Thse switches have been designed into extremely small cases which are setting a new standard for convenience and miniaturization in the industry.

The AH Series uses Avantek's all thin-film design technology for superb reliability and repeatibility. All hybrid components are eutectically die attached and thermocompression bonded.

Avantek offers three different types of AH switches—SPST, SPDT and SPMT. Each type provides a complete range of options which includes:

- Frequency coverage from 2-4 GHz to 2-18 GHz
- Female SMA, male SMA or connectorless RF interface
- Integral TTL compatible high speed drivers
- High reliability "R" Series screening
- Low insertion loss/High isolation options

Th AH Series case is stainless steel and laser welded for hermeticity. Numerous case mounting holes are provided for ease of installation into stripline assemblies.

SPST SWITCHES

Avantek offers two series of single-pole-single throw switches. The low loss (–0) series are designed to provide 40 dB of isolation while the (–1) series offers over 60 dB of isolation. Both are available with TTL compatible hybrid switch drivers and have typical switching speed of under 10 nanoseconds from 10-90% of the detected RF. These units are extremely small (less than .07 cubic inches) and weigh less than 6 grams without connectors.

SPDT SWITCHES

The Avanpak AHD-0 Series of reflective single-pole-double-throw switches are designed to operate over the full 2-18 GHz band and provide very low insertion loss and VSWR while delivering over 50 dB of isolation. They are available with TTL compatible hybrid switch drivers and have typical switching speed of under 10 nanoseconds from 10-90% of the detected RF. These units are extremely small (less than .07 cubic inches) and weigh less than 7 grams without connectors.

SPMT SWITCHES

The Avanpak AHT-0, AHQ-0 and AHF-0 Series of reflective single-pole-multi-throw switches are designed to operate over the entire 2-18 GHz band and provide very low insertion loss and VSWR while delivering over 50 dB of isolation. They are available with TTL compatible hybrid switch drivers and have typical switching speed of under 10 nanoseconds from 10-90% of the detected RF. These units are extremely small (less than .2 cubic inches) and weigh less than 18 grams without connectors.

PLANARPAK™ SURFACE MOUNT SWITCH

The PPS-010 is a single-pole-double-throw surface mount switch which covers the 10-2000 MHz frequency range.

This PlanarPak switch is a non-reflective device that offers low insertion loss.

The PPS-010 is supplied in the newly designed surface mount package which allows the use of simpler microstrip installation at higher densities and improved performance.

Selection Guide

AH Series, Pin-Diode Switches (Guaranteed Specifications @ 25°C Case Temperature)

Model Number	Frequency (GHz)	Switching Speed[3] (Nanoseconds) Maximum	Isolation (dB), Min.	VSWR Maximum	Insertion Loss Max (dB) Freq. GHz				Dimensions			Page No.
					2.0–4.0	4.0–8.0	8.0–12.0	12.0–18.0	Length (in.)	Width (in.)	Height (in.)	
LOW LOSS SINGLE POLE SINGLE THROW												
AHS-0402-0	2.0–4.0	50	40	1.8	0.9	—	—	—	.590	.530	.190	316
AHS-0802-0	2.0–8.0	50	40	1.8	0.9	1.2	—	—				316
AHS-1202-0	2.0–12.0	50	40	1.8	0.9	1.2	1.7	—				316
AHS-1802-0	2.0–18.0	50	40	1.8	0.9	1.2	1.7	2.1				316
HIGH ISOLATION SINGLE POLE SINGLE THROW												
AHS-0402-1	2.0–4.0	50	55	1.8	1.1	—	—	—	.590	.530	.190	316
AHS-0802-1	2.0–8.0	50	60[6]	1.8	1.1	1.4	—	—				316
AHS-1202-1	2.0–12.0	50	60[6]	1.8	1.1	1.4	1.9	—				316
AHS-1802-1	2.0–18.0	50	60[6]	1.8	1.1	1.4	1.9	2.4				316
SINGLE POLE DOUBLE THROW												
AHD-0402-0	2.0–4.0	100	50	1.8	1.3	—	—	—	.690	.530	.190	318
AHD-0802-0	2.0–8.0	100	50	1.8	1.3	1.8	—	—				318
AHD-1202-0	2.0–12.0	100	50	1.8	1.3	1.8	2.3	—				318
AHD-1802-0	2.0–18.0	100	50	1.8	1.3	1.8	2.3	2.9				318
SINGLE POLE TRIPLE THROW												
AHT-0402-0	2.0–4.0	100	50	2.0	1.4	—	—	—	.966	Octagonal	.240	320
AHT-0802-0	2.0–8.0	100	50	2.0	1.4	2.0	—	—				320
AHT-1202-0	2.0–12.0	100	50	2.0	1.4	2.0	2.5	—				320
AHT-1802-0	2.0–18.0	100	50	2.0	1.4	2.0	2.5	3.1				320
SINGLE POLE FOUR THROW												
AHQ-0402-0	2.0–4.0	100	50	2.0	1.6	—	—	—	.966	Octagonal	.240	320
AHQ-0802-0	2.0–8.0	100	50	2.0	1.6	2.2	—	—				320
AHQ-1202-0	2.0–12.0	100	50	2.0	1.6	2.2	2.7	—				320
AHQ-1802-0	2.0–18.0	100	50	2.0	1.6	2.2	2.7	3.4				320
SINGLE POLE FIVE THROW												
AHF-0402-0	2.0–4.0	100	50	2.0	1.7	—	—	—	.966	Otagonal	.240	320
AHF-0802-0	2.0–8.0	100	50	2.0	1.7	2.2	—	—				320
AHF-1202-0	2.0–12.0	100	50	2.0	1.7	2.2	2.7	—				320
AHF-1802-0	2.0–18.0	100	50	2.0	1.7	2.2	2.7	3.5				320

NOTES 1: Driver option. All units are available with high speed TTL drivers.
2: Connector option. All units are available with removable SMA male or female connectors.
3: Speed is defined as 50% input trigger to 90% detected RF change including driver delay. Rise and fall times are less than 15 ns typical.
4: All specifications are at +10 dBm input power. Maximum input is +30 dBm.
5: Operating temperature: −55°C to +100°C.
6: Isolation equals 55 dB (min.) from 2.0–4.0 GHz.
7: Dimensions excluding connectors.

PlanarPak™, Non Reflective, SPDT, Surface Mount Switch (Guaranteed Specifications @ 25°C Case Temperature)

Model	Frequency (MHz)	Insertion Loss (dB)	Isolation (dB)	VSWR (50Ω)	Switching Speed (μsec)	Control Voltage (VDC)	Page No.
PPS-010	10-200	1.5	40	1.7	5.0	±15	322
	200-500	1.5	30				
	500-2000	2.5	20				

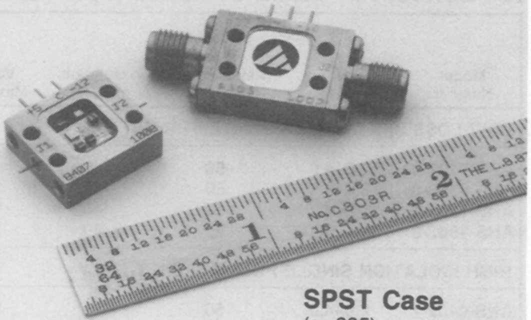
AHS-0 Series
AHS-1 Series

Thin Film Switches
Single-Pole-Single-Throw
2-18 GHz

AVANTEK

FEATURES

- **Subminiature Avanpak Package**
- **Full Band 2-18 GHz Performance**
- **All Thin Film Construction**
- **Laser Welded — Truly Hermetic**
- **Removable SMA Connectors**
- **Low Insertion Loss**
- **Low VSWR**
- **High Isolation**



SPST Case
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AVANPAK™ THIN-FILM PIN-DIODE SWITCHES (Guaranteed Specifications at +25°C Case Temperature)

Frequency		2.0–4.0 GHz			4.0–8.0 GHz			8.0–12.0 GHz			12.0–18.0 GHz		
Type	Model Number*	Insertion Loss (dB) Max	VSWR Max	Isolation (dB) Min	Insertion Loss (dB) Max	VSWR Max	Isolation (dB) Min	Insertion Loss (DB) Max	VSWR Max	Isolation (dB) Min	Insertion Loss (dB) Max	VSWR Max	Isolation (dB) Min.
Low loss	AHS0402-0XX	0.9	1.8	40	—	—	—	—	—	—	—	—	—
Single Pole	AHS0802-0XX	0.9	1.8	40	1.2	1.8	40	—	—	—	—	—	—
Single Throw	AHS1202-0XX	0.9	1.8	40	1.2	1.8	40	1.7	1.8	40	—	—	—
Speed <50 nsec.	AHS1802-0XX	0.9	1.8	40	1.2	1.8	40	1.7	1.8	40	2.1	1.8	40
High Isolation	AHS0402-1XX	1.1	1.8	55	—	—	—	—	—	—	—	—	—
Single Pole	AHS0802-1XX	1.1	1.8	55	1.4	1.8	60	—	—	—	—	—	—
Single Throw	AHS1202-1XX	1.1	1.8	55	1.4	1.8	60	1.9	1.8	60	—	—	—
Speed <50 nsec.	AHS1802-1XX	1.1	1.8	55	1.4	1.8	60	1.9	1.8	60	2.4	1.8	60

NOTES 1: Speed is defined as 50% input trigger to 90% RF change including driver delay. Rise and fall times <15 nanoseconds typical.
2: All specifications at +10 dBm input power. Maximum input is +30 dBm.
3: Operating temperature: −55°C to +100°C.

*See next page for Model Number Description.

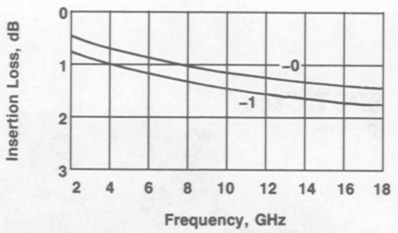
MAXIMUM RATINGS

DC Voltage	+5.5 V/−16.5 V
RF Input Power (CW/Pulse)	
Into "ON" PATH	1 W CW/10 W 1μsec Pulse Width
Into "OFF" PATH	1 W CW/10 W 1μsec Pulse Width
Operating Case Temperature	125°C
Storage Temperature	150°C
"R" Series Burn-In Temperature	125°C

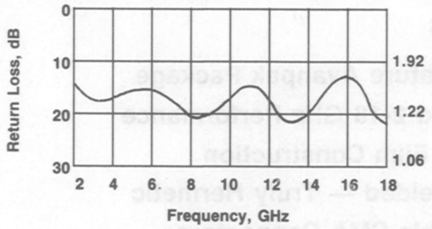
WEIGHT: (typical) With Connectors and Spacer = 11.5 grams; Without Connectors and Spacer = 5.5 grams

TYPICAL PERFORMANCE AT 25°C

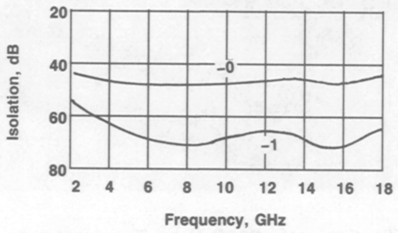
Insertion Loss



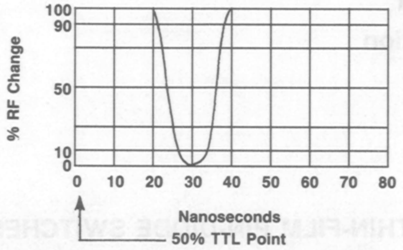
Return Loss/VSWR



Isolation

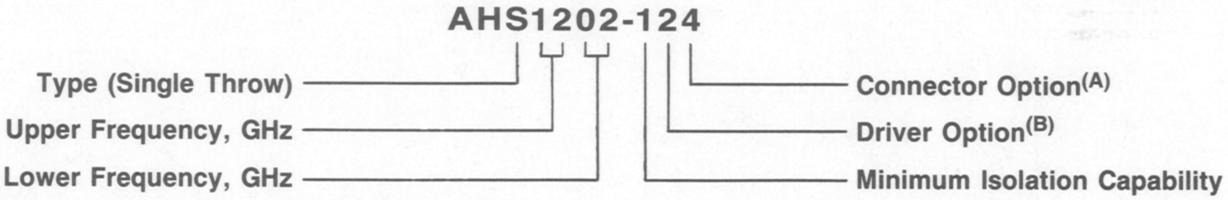


Switching Speed



MODEL NUMBERING DESCRIPTION

TYPICAL PART NUMBER


AHS1202-124
Type (Single Throw)
Upper Frequency, GHz
Lower Frequency, GHz
Connector Option(A)
Driver Option(B)
Minimum Isolation Capability

(A) CONNECTOR OPTION TABLE		
Dash No.	J1	J2
-XX1	FEM	FEM
-XX2	NONE	NONE
-XX3	MALE	MALE
-XX4	MALE	FEM
-XX5	FEM	MALE

(B) DRIVER OPTION TABLE		
	Control Input C	
Dash No.	Insertion Loss	Isolation
-X0X	–10V	+30 mA
-X1X	TTL LO	TTL HI
-X2X	TTL HI	TTL LO

Driver Bias: +5±.5V at 150 mA maximum
–5 to –15V at 75 mA maximum
TTL LO = 0 to .8V at 1.6 mA maximum sink
TTL HI = 2 to 5V at 40 μA maximum source

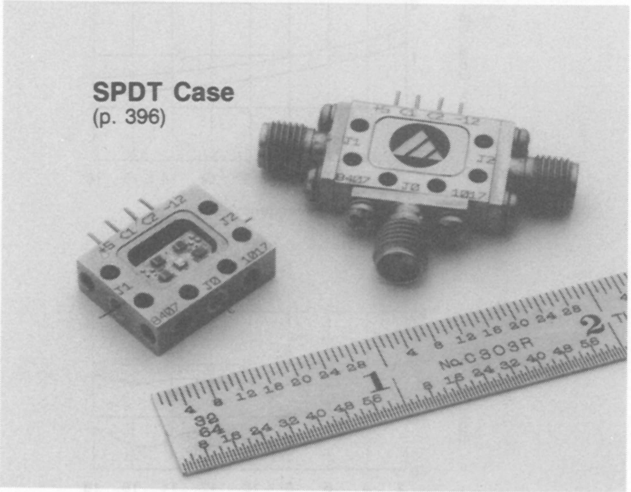
AHD-0 Series

Thin Film Switches
Single-Pole-Double-Throw
2-18 GHz

AVANTEK

FEATURES

- **Subminiature Avanpak Package**
- **Full Band 2-18 GHz Performance**
- **All Thin Film Construction**
- **Laser Welded — Truly Hermetic**
- **Removable SMA Connectors**
- **Low Insertion Loss**
- **Low VSWR**
- **High Isolation**



SPDT Case
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AVANPAK™ THIN-FILM PIN-DIODE SWITCHES (Guaranteed Specifications at +25°C Case Temperature)

Type	Model Number*	2.0–4.0 GHz Insertion Loss (dB) Max	2.0–4.0 GHz VSWR Max	2.0–4.0 GHz Isolation (dB) Min	4.0–8.0 GHz Insertion Loss (dB) Max	4.0–8.0 GHz VSWR Max	4.0–8.0 GHz Isolation (dB) Min	8.0–12.0 GHz Insertion Loss (DB) Max	8.0–12.0 GHz VSWR Max	8.0–12.0 GHz Isolation (dB) Min	12.0–18.0 GHz Insertion Loss (dB) Max	12.0–18.0 GHz VSWR Max	12.0–18.0 GHz Isolation (dB) Min
Single Pole	AHD0402-0XX	1.3	1.8	50	—	—	—	—	—	—	—	—	—
Double Throw	AHD0802-0XX	1.3	1.8	50	1.8	1.8	50	—	—	—	—	—	—
Speed <100 nsec.	AHD1202-0XX	1.3	1.8	50	1.8	1.8	50	2.3	1.8	50	—	—	—
	AHD1802-0XX	1.3	1.8	50	1.8	1.8	50	2.3	1.8	50	2.9	1.8	50

NOTES 1: Speed is defined as 50% input trigger to 90% RF change including driver delay. Rise and fall times <15 nanoseconds typical.
2: All specifications at +10 dBm input power. Maximum input is +30 dBm.
3: Operating temperature: −55°C to +100°C.

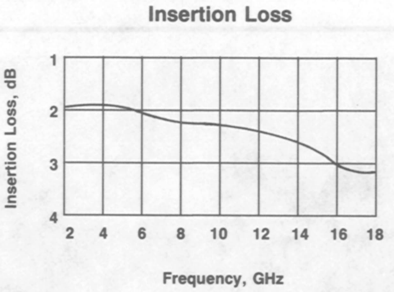
*See next page for Model Number Description.

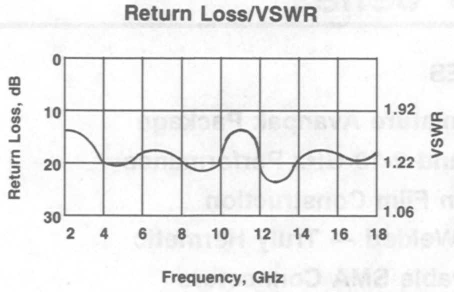
MAXIMUM RATINGS

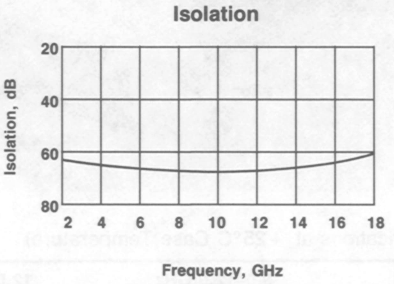
DC Voltage	+5.5 V/−16.5 V
RF Input Power (CW/Pulse)	
Into "ON" Path	1 W CW/10 W 1μsec Pulse Width
Into "OFF" Path	1 W CW/10 W μsec Pulse Width
Operating Case Temperature	125°C
Storage Temperature	150°C
"R" Series Burn-In Temperature	125°C

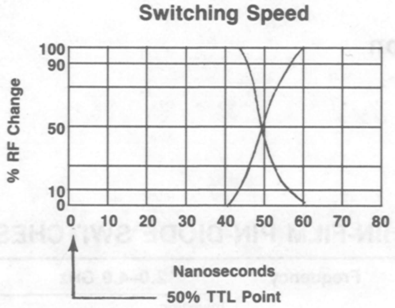
WEIGHT: (typical) With Connectors and Spacer = 14.5 grams; Without Connectors and Spacer = 6.5 grams

TYPICAL PERFORMANCE AT 25°C



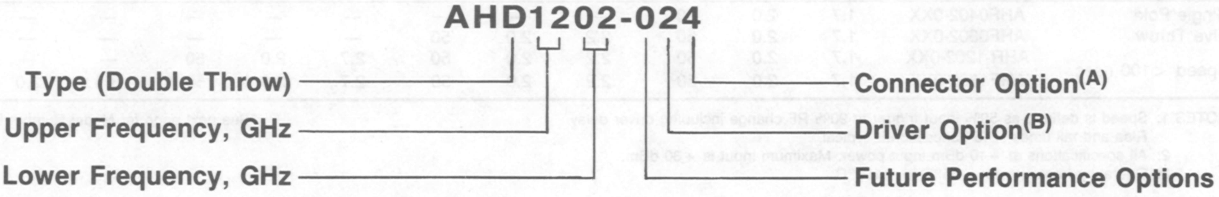






MODEL NUMBERING DESCRIPTION

TYPICAL PART NUMBER


AHD1202-024
Type (Double Throw)
Upper Frequency, GHz
Lower Frequency, GHz
Connector Option(A)
Driver Option(B)
Future Performance Options

(A) CONNECTOR OPTION TABLE			
Dash	J0	J1	J2
-0X1	FEM	FEM	FEM
-0X2	NONE	NONE	NONE
-0X3	MALE	MALE	MALE
-0X4	MALE	FEM	FEM
-0X5	FEM	MALE	MALE

(B) DRIVER OPTION TABLE				
Dash No.	C1		C2	
	Insertion Loss	Isolation	Insertion Loss	Isolation
-00X	−30 mA	+30 mA	−30 mA	+30 mA
-01X	TTL LO	TTL HI	TTL LO	TTL HI
-02X	TTL HI	TTL LO	TTL HI	TTL LO
-03X	TTL LO	TTL HI	TTL HI	TTL LO
-04X	TTL HI	TTL LO	TTL LO	TTL HI

Driver Bias: +5.0 ± 0.5V at 150 mA maximum
−5.0 to −15.0V at 75 mA maximum

TTL LO = 0 to 0.8V at 1.6 mA maximum sink
TTL HI = 2.0 to 5.0V at 40 μA maximum source

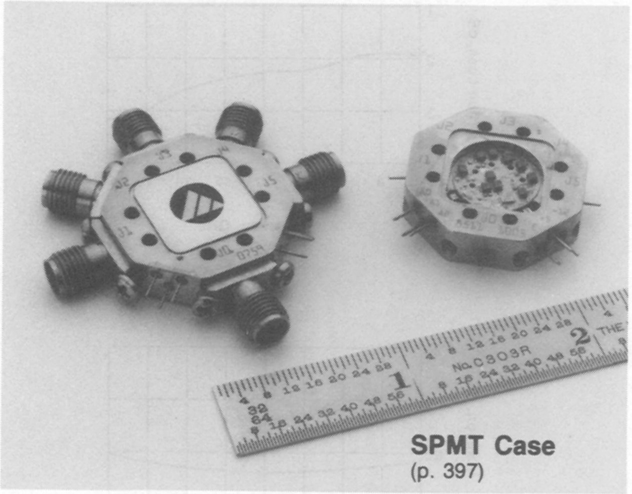
AHT-0 Series
AHQ-0 Series
AHF-0 Series

Thin Film Switches
Single-Pole-Multi-Throw
2-18 GHz

AVANTEK

FEATURES

- **Subminiature Avanpak Package**
- **Full Band 2-18 GHz Performance**
- **All Thin Film Construction**
- **Laser Welded — Truly Hermetic**
- **Removable SMA Connectors**
- **Low Insertion Loss**
- **Low VSWR**
- **High Isolation**



SPMT Case
(p. 397)

AVANPAK™ THIN-FILM PIN-DIODE SWITCHES (Guaranteed Specifications at +25°C Case Temperature)

	Frequency	2.0–4.0 GHz			4.0–8.0 GHz			8.0–12.0 GHz			12.0–18.0 GHz		
Type	Model Number*	Insertion Loss (dB) Max	VSWR Max	Isolation (dB) Min	Insertion Loss (dB) Max	VSWR Max	Isolation (dB) Min	Insertion Loss (DB) Max	VSWR Max	Isolation (dB) Min	Insertion Loss (dB) Max	VSWR Max	Isolation (dB) Min
Single Pole	AHT0402-0XX	1.4	2.0	50	—	—	—	—	—	—	—	—	—
Triple Throw	AHT0802-0XX	1.4	2.0	50	2.0	2.0	50	—	—	—	—	—	—
Speed <100 nsec.	AHT1202-0XX	1.4	2.0	50	2.0	2.0	50	2.5	2.0	50	—	—	—
	AHT1802-0XX	1.4	2.0	50	2.0	2.0	50	2.5	2.0	50	3.1	2.0	50
Single Pole	AHQ0402-0XX	1.6	2.0	50	—	—	—	—	—	—	—	—	—
Four Throw	AHQ0802-0XX	1.6	2.0	50	2.2	2.0	50	—	—	—	—	—	—
Speed <100 nsec.	AHQ1202-0XX	1.6	2.0	50	2.2	2.0	50	2.7	2.0	50	—	—	—
	AHQ1802-0XX	1.6	2.0	50	2.2	2.0	50	2.7	2.0	50	3.4	2.0	50
Single Pole	AHF0402-0XX	1.7	2.0	50	—	—	—	—	—	—	—	—	—
Five Throw	AHF0802-0XX	1.7	2.0	50	2.2	2.0	50	—	—	—	—	—	—
Speed <100 nsec.	AHR-1202-0XX	1.7	2.0	50	2.2	2.0	50	2.7	2.0	50	—	—	—
	AHF1802-0XX	1.7	2.0	50	2.2	2.0	50	2.7	2.0	50	3.5	2.0	50

NOTES 1: Speed is defined as 50% input trigger to 90% RF change including driver delay.
Rise and fall times <15 nanoseconds typical.
2: All specifications at +10 dBm input power. Maximum input is +30 dBm.
3: Operating temperature: −55°C to +100°C.

*See next page for Model Number Description.

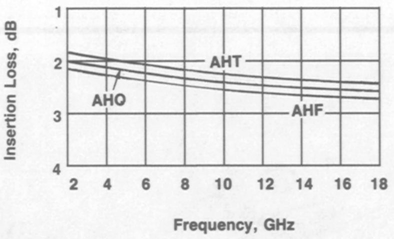
MAXIMUM RATINGS

DC Voltage	+5.5 V/−16.5 V
RF Input Power (CW/Pulse)	
Into "ON" Path	1 W CW/10 W 1μsec Pulse Width
Into "OFF" Path	1 W CW/10 W 1μsec Pulse Width
Operating Case Temperature	125°C
Storage Temperature	150°C
"R" Series Burn-In Temperature	125°C

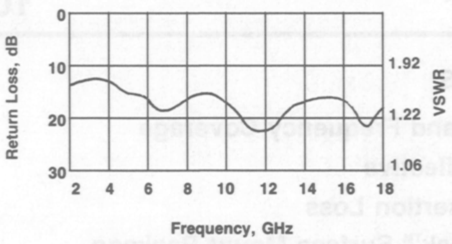
WEIGHT: (typical) With Connectors and Spacer = 26.5 grams; Without Connectors and Spacer = 17.5 grams

TYPICAL PERFORMANCE AT 25°C

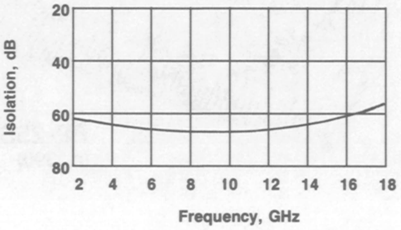
Insertion Loss



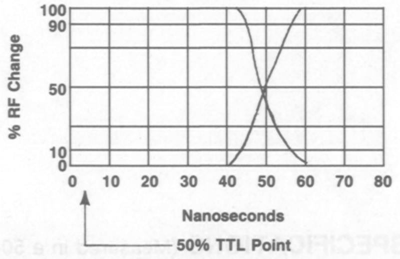
Return Loss



Isolation

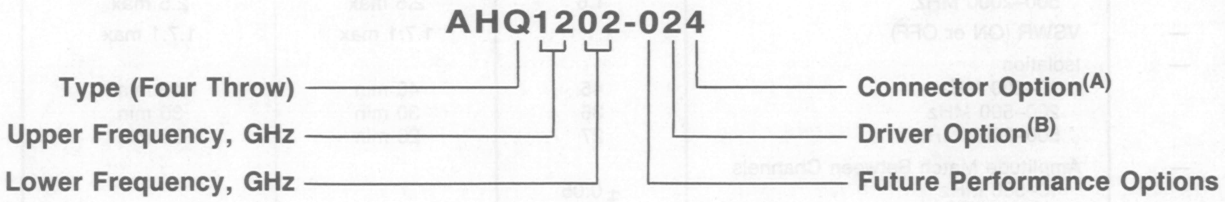


Switching Speed



MODEL NUMBERING DESCRIPTION

TYPICAL PART NUMBER


AHQ1202-024
Type (Four Throw)
Upper Frequency, GHz
Lower Frequency, GHz
Connector Option(A)
Driver Option(B)
Future Performance Options

(A) CONNECTOR OPTION TABLE

Dash	J0	J1-J5
-0X1	FEM	FEM
-0X2	NONE	NONE
-0X3	MALE	MALE
-0X4	MALE	FEM
-0X5	FEM	MALE

(B) DRIVER DESIGNATOR

Dash No.	Type	Low Insertion Loss	Isolation
X0X	No Driver	+30 mA	−20 mA
X1X	No Driver	−30 mA	+20 mA
X2X	Decoded Driver	See truth table	
X3X	Standard Driver	TTL LO	TTL HI
X4X	Inverted Driver	TTL HI	TTL LO

Note: X3X and X4X dash # not available with SP5T models.

Truth Table for X2X Decoded Driver

LOW LOSS PORT	TTL Input Level			
	A0	A1	A2	E
J1	1	0	0	1
J2	0	1	0	1
J3	1	1	0	1
J4	0	0	1	1
J5	1	0	1	1
ALL OFF	X	X	X	0

Driver Bias: +5.0 ± 0.5V at 75 mA maximum.
−5.0 to −15.0V at 150 mA maximum.

TTL LO = 0 to 0.8V at 1.6 mA maximum sink.
TTL HI = 2.0 to 5.0V at 40 μA maximum source.

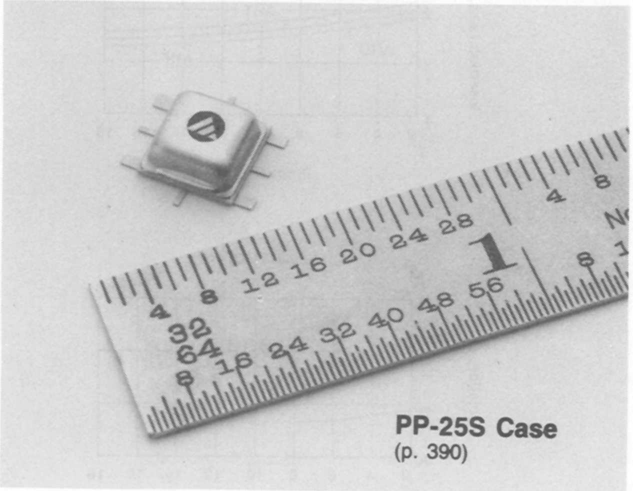
PPS-010

Surface Mount SPDT Switch 10-2000 MHz

AVANTEK

FEATURES

- **Broadband Frequency Coverage**
- **Non-Reflective**
- **Low Insertion Loss**
- **PlanarPak™ Surface Mount Package**



PP-25S Case
(p. 390)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	Guaranteed Specifications $T_C = -55°$ to $+85°C$	Unit
BW	Frequency Range	10–2000 MHz	10–2000 MHz	10–2000 MHz	MHz
—	Insertion Loss				
	10–500 MHz	1.1	1.5 max	1.5 max	dB
	500–2000 MHz	1.6	2.5 max	2.5 max	db
—	VSWR (ON or OFF)	1.1:1	1.7:1 max	1.7:1 max	
—	Isolation				
	10–200 MHz	45	40 min	40 min	dB
	200–500 MHz	36	30 min	30 min	dB
	500–2000 MHz	27	20 min	20 min	dB
—	Amplitude Match Between Channels				
	10–500 MHz	±0.05			dB
	500–2000 MHz	±0.1			dB
—	Phase Match Between Channels	±1			Degree
IP_3	Third Order Intercept Point				
	10–100 MHz	+30			dBm
	100–2000 MHz	+41			dBm
HP_2	Second Harmonic Intercept Point				
	10–100 MHz	+52			dBm
	100–2000 MHz	+65			dBm
—	Switching Speed (10–90%)	5			μsec
—	Control Voltage	±15			Volts
—	Current @ ±15 Volts	7			mA

MAXIMUM RATINGS

DC Voltage .... ±17 Volts

RF Input Power (CW or Pulse)

Into "ON" Channel .... +26 dBm

Into "OFF" Channel .... +21 dBm

Operating Case Temperature .... −55°C to +125°C

Storage Temperature .... −62°C to +150°C

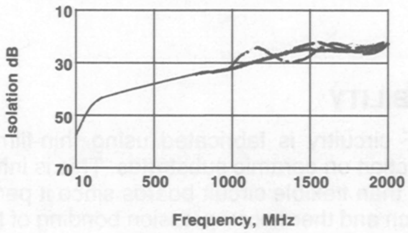
"R" Series Burn-in Temperature .... +125°C

WEIGHT: (typical) 0.2 grams

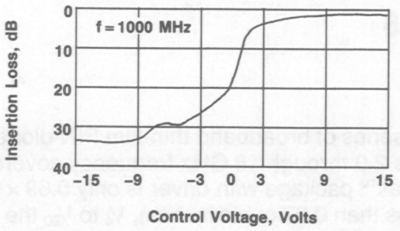
TYPICAL PERFORMANCE AT 25°C

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

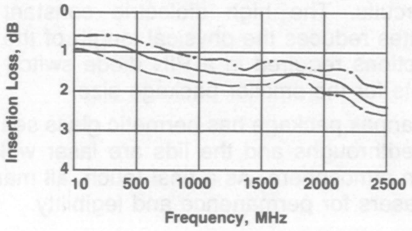
Isolation



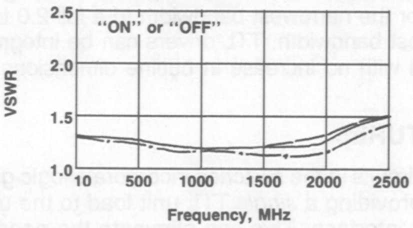
Insertion Loss vs. Control Voltage



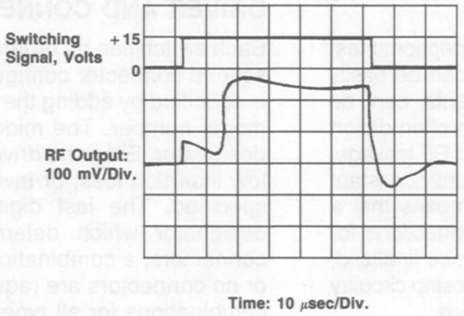
Insertion Loss



VSWR Worst Case, All Ports



Switching Speed
RF Input: 20 MHz @ 0 dBm



Application Notes

AH SWITCHES

DESCRIPTION

The Avantek AH series of broadband thin-film PIN-diode RF switches provides 2.0 through 18 GHz frequency coverage. The SPDT Avanpak™ package with driver is only 0.69 × 0.53 × 0.19 inches (less than 0.07 cubic inches), ¼ to ¹⁄₂₀ the size of similar available units. Avantek's other control devices are equally small in size.

Each series features four different frequency bands starting with 2.0 to 4.0 GHz for the narrowest bandwidth to a full 2.0 to 18 GHz for the widest bandwidth. TTL drivers can be integrated into every switch with no increase in outline dimensions.

DESIGN FEATURES

Thin-film driver circuits in the switches incorporate logic gates at their inputs, providing a *single* TTL unit load to the user-supplied control interface. This can eliminate the need for buffers to increase the fanout of a complex system, thereby reducing power consumption and propagation delay. Each driver features laser-trimmed thin-film resistors for accuracy and repeatable performance.

The Avanpak package provides the user with exceptional test and installation flexibility. Since RF connectors can be easily installed on the package, Avanpak components can be evaluated without the need for test fixtures which often distort RF measurements by introducing mismatches and RF leakage. The RF performance of the switches remains virtually constant whether or not the connectors are used. This means that a system may be prototyped using coaxial interconnections for easy modification or component replacement. Once finalized, the system may then go into production using microstrip circuitry without unexpected changes in RF characteristics.

RELIABILITY

The RF circuitry is fabricated using thin-film MIC hybrid construction on ceramic substrates. This is inherently more reliable than flexible circuit boards since it permits eutectic die attach and thermocompression bonding of the diode and capacitor chips to the circuit conductors. More repeatable performance is also achieved with this construction since better definition and closer tolerances are possible in thin-film circuits. The high dielectric constant of ceramic substrates reduces the physical length of the quarterwave line sections required in a PIN diode switch and partially accounts for the smaller package size.

The Avanpak package has hermetic glass seals for RF and bias feedthroughs and the lids are laser welded in a dry nitrogen atmosphere. As a final touch, all marking is done using lasers for permanence and legibility.

DRIVER AND CONNECTOR OPTIONS

Each switch can be ordered with or without a driver and with several connector configurations. The desired combination is specified by adding the correct suffix numbers to the basic model number. The middle digit in the suffix is the driver designator. Either no driver, standard low level TTL logic for low insertion loss, or inverting low level TTL logic may be specified. The last digit in the suffix is the connector designator which determines whether all SMA female connectors, a combination of male and female connectors, or no connectors are required. These tables provide option combinations for all types of switches.

SPST SWITCH

AHS1802-XXX

Upper frequency (GHz)

Lower frequency (GHz)

0 — Low loss design
1 — High isolation design

Connector Designator

1 — Removable female SMA connector both ports
2 — No connectors (pins only)
3 — Removable male SMA connectors both ports
4 — Removable male SMA connector on J1
Removable female SMA connector on J2
5 — Removable female SMA connector on port J1
Removable male SMA connector on port J2

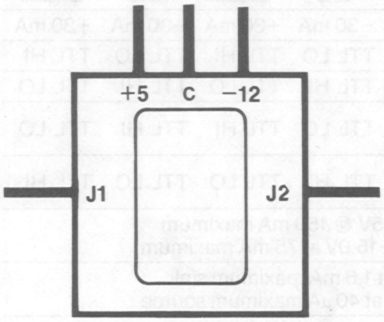
Driver Designator

Command Input

Dash #	Type	Low Insertion Loss	Isolation
X0X	No Driver	−10V	+30 mA
X1X	Standard Logic	TTL LO	TTL HI
X2X	Inverting Logic	TTL HI	TTL LO

Driver Bias: +5±.5V at 150 mA maximum
−5 to −15V at 75 mA maximum

TTL LO = 0 to .8V at 1.6 mA maximum sink
TTL HI = 2 to 5V at 40 μA maximum source



SPDT SWITCH

AHD 1802-XXX

Upper frequency (GHz)

Lower frequency (GHz)

Connector Designator

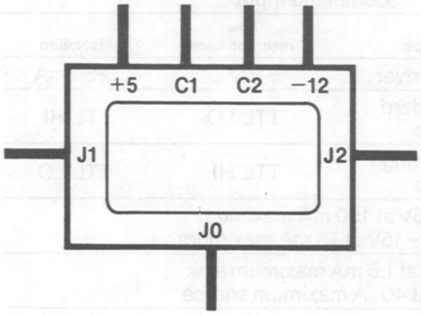
1. Removable female SMA connectors all three ports
2. No connectors (pins only)
3. Removable male SMA connectors all three ports
4. Removable male SMA connectors on port J0. Removable female SMA connectors on ports J1 and J2.
5. Removable female SMA connector on port J0. Removable male SMA connector on ports J1 and J2.

Driver Designator

Dash #	Type	Command Input #1		Command Input #2	
		Insertion Loss	Isolation	Insertion Loss	Isolation
00X	No Driver	−30 mA	+30 mA	−30 mA	+30 mA
01X	Standard Logic	TTL LO	TTL HI	TTL LO	TTL HI
02X	Inverting Logic	TTL HI	TTL LO	TTL HI	TTL LO
03X	Standard/ Inverting Logic	TTL LO	TTL HI	TTL HI	TTL LO
04X	Inverting/ Standard Logic	TTL HI	TTL LO	TTL LO	TTL HI

Driver Bias: +5.0 ±0.5V @ 150 mA maximum
−5.0 to −15.0V at 75 mA maximum

TTL LO = 0 to 0.8V at 1.6 mA maximum sink
TTL HI = 2.0 to 5.0V at 40 μA maximum source



SPMT SWITCH

T
AHQ 1802-0XX
F

Number of Throws	Standard Outputs*
T = 3 Throw	J1, J3, J5
Q = 4 Throw	J1, J2, J4, J5
F = 5 Throw	J1 Thru J5

*Other ports available on request

Upper frequency (GHz)

Lower frequency (GHz)

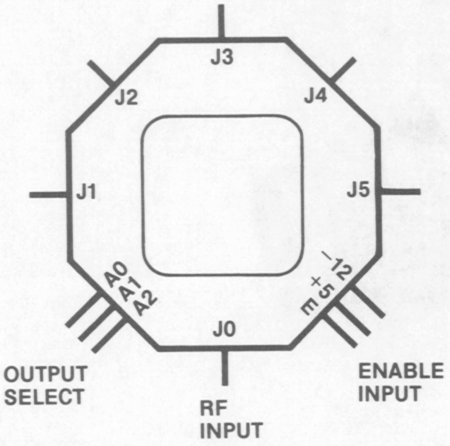
Connector Designator

1. Removable female SMA connectors all ports
2. No connectors (pins only)
3. Removable male SMA connectors all ports
4. Removable male SMA connector on port J0. Removable female SMA connectors on all other ports.
5. Removable female SMA connector on port J0. Removable male SMA connectors on all other ports.

Driver Designator

Dash #	Type	Low Insertion Loss	Isolation
X0X	No Driver	+30 mA	−20 mA
X1X	No Driver	−30 mA	−20 mA
X2X	Decoded Driver	See truth table	
X3X	Standard Driver	TTL LO	TTL HI
X4X	Inverted Driver	TTL HI	TTL LO

Note: -X3X and -X4X dash # not available with SP5T models.



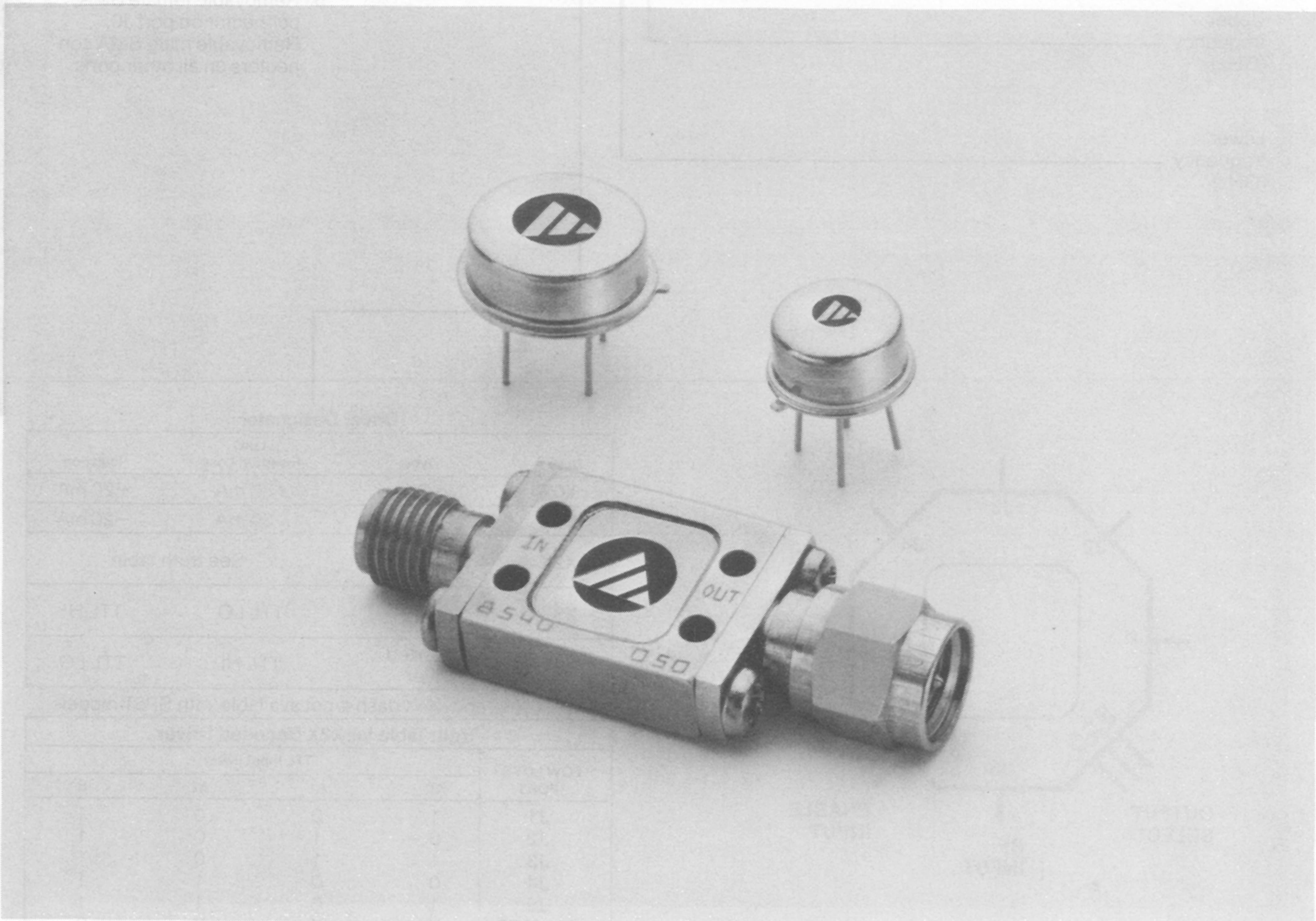
Truth Table for X2X Decoded Driver

LOW LOSS PORT	TTL Input Level			
	A0	A1	A2	E
J1	1	0	0	1
J2	0	1	0	1
J3	1	1	0	1
J4	0	0	1	1
J5	1	0	1	1
ALL OFF	X	X	X	0

Driver Bias: +5.0 ± 0.5V at 75 mA maximum
−5.0 to −15.0V at 150 mA maximum

TTL LO = 0 to 0.8V at 1.6 mA maximum sink
TTL HI = 2.0 to 5.0V at 40 μA maximum source

PRODUCT DATA


IN
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• LIMITERS

Product Descriptions 330

Selection Guide 331

Data Sheets

- Voltage Controlled Signal Limiters 332
- Avanpak Limiters 336

Application Notes 338

See Page 4 for a complete Alphanumeric Listing of Modular Products.

Product Descriptions

AVANPAK THIN-FILM LIMITERS

The AH Series of thin-film limiters covers the full 2-18 GHz frequency range. They are offered in the subminiature limiter package with field replaceable SMA connectors.

These Avanpak passive limiters are used to protect sensitive components from high peak or CW power levels while maintaining low insertion loss and VSWR under low power conditions. The units incorporate all required ground returns and DC blocks, providing a complete component within a very small hermetic package.

Avantek offers two series of passive microwave limiters. The low loss (–0) series are designed to handle up to 200 watts peak and 2 watts CW. The high power (–1) series will handle 1000 watts peak and 4 watts CW. Peak power ratings are for one microsecond pulses at a .1 percent duty cycle.

Avanpak limiters are available with high reliability "R" Series screening. Avantek uses all thin-film design technology for superb reliability and repeatability. All hybrid components are eutectically die attached and thermocompression bonded.

The stainless steel Avanpak case is laser welded for hermeticity. Numerous case mounting holes are provided for ease of installation into stripline assemblies.

VOLTAGE CONTROLLED SIGNAL LIMITERS

The UTL/GPL Series consists of voltage controlled signal limiters which cover the 5 to 1000 MHz frequency range.

These thin-film limiters feature voltage programmable output levels with input levels as high as +26 dBm. They have VSWR of less than 2:1, low insertion loss, excellent second and third-harmonic suppression, and very low AM-to-PM conversion. Recovery from fully saturated input levels is less than 50 nanoseconds.

The UTL model is provided in the TO-8 package and the GPL model is available in the smaller TO-12 case.

Selection Guide

UTL/GPL Series, Voltage Controlled Signal Limiters (Guaranteed Specifications @ 25°C Case Temperature)

Model	Frequency Range (MHz)	Input Power Limiting Range (dBm) Minimum	Saturated Output Power (dBm) Minimum	Output Flatness (dB) Maximum	Insertion Loss (dB) Maximum	Operating Bias (VAC) Nominal	Page No.
UTL-1001	50–1000	0 to +20	−10 to 0[1]	±1.0	3.0	+5 to +20	332
UTL-1002	5–1000	0 to +20	−10 to 0[1]	±1.0	3.0	+5 to +20	332
GPL-1001	5–1000	0 to +20	−4.0	±1.0	5.0	+15	334

NOTES 1: Determined by bias voltage.

Avanpak, Medium Power Thin-Film Limiters

(Guaranteed Specifications @ 25°C Case Temperature, -55° to +85°C Operating Temperature)

Model	Frequency Range (GHz)	VSWR Maximum	Maximum Insertion Loss (dB) at Frequency (GHz) 2–4	4–8	8–12	12–18	Page No.
AHL-0402-0	2–4	1.8	1.0	—	—	—	336
AHL-0802-0	2–8	1.8	1.0	1.3	—	—	336
AHL-1202-0	2–12	1.8	1.0	1.3	1.8	—	336
AHL-1802-0	2–18	1.8	1.0	1.3	1.8	2.2	336

NOTES 1: All specifications at -10 dBm power.
2: Case dimensions and weight are exclusive of connectors.

Additional Specifications which apply to all units:
1: Limiting threshold + dBm, typical.
2: Flat leakage: 100 mW maximum with 200 Watts peak 1.0 microsecond pulse width; 0.1% duty cycle.
3: Spike leakage: 0.1 erg maximum with 20 nanosecond risetime pulses.
4: Maximum continuous input 2 Watts.
5: Recovery time: 100 nS maximum.

Avanpak, High Power Thin-Film Limiters

Guaranteed Specifications @ 25°C Case Temperature, -55°C to +85°C Operating Temperature)

Model	Frequency Range (GHz)	VSWR Maximum	Maximum Insertion Loss (dB) at Frequency (GHz) 2–4	4–8	8–12	12–18	Page No.
AHL-0402-1	2–4	1.8	1.4	—	—	—	336
AHL-0802-1	2–8	1.8	1.4	1.8	—	—	336
AHL-1202-1	2–12	1.8	1.4	1.8	2.2	—	336
AHL-1802-1	2–18	1.8	1.4	1.8	2.2	2.8	336

NOTES 1: All specifications at -10 dBm power.
2: Case dimensions and weight are exclusive of connectors.

Additional Specifications which apply to all units:
1: Limiting threshold + dBm, typical.
2: Flat leakage: 100 mW maximum with 1000 Watts peak 1.0 microsecond pulse width; 0.1% duty cycle.
3: Spike leakage: 0.1 erg maximum with 20 nanosecond risetime pulses.
4: Maximum continuous input 4 Watts.
5: Recovery time: 200 nS maximum.

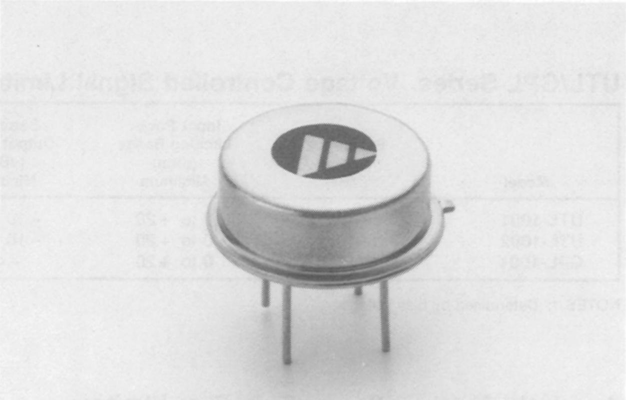
UTL-1001/1002

Voltage Controlled Signal Limiter 5-1000 MHz

AVANTEK

FEATURES

- **AM to PM Conversion <0.2°/dB**
- **0 to –13 dBm Programmable Output**
- **VSWR <2.0:1**



TO-8U Case
(p. 402)

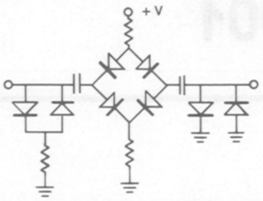
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	Unit
BW	Frequency Range				
	UTL-1001	50–1000	50–1000	50–1000	MHz
	UTL-1002	5–1000	5–1000	5–1000	MHz
—	Output Level at Limiting Threshold (1 dB Compression)				
	+20 volts bias	0	+2		dBm
	+15 volts bias	–2	0	—	dBm
	+10 volts bias	–6	–4	—	dBm
	+5 volts bias	–13	—	—	dBm
—	Maximum Output Limiting Level (+20 dBm Input)				
	+20 volts bias	0	+2		dBm
	+15 volts bias	–1	+1	—	dBm
	+10 volts bias	–4	–2	—	dBm
	+5 volts bias	–9	—	—	dBm
	Maximum Insertion Loss at 500 MHz				
	+20 volts bias	1.6	2.0	—	dB
	+15 volts bias	1.9	2.4	—	dB
	+10 voltsbias	2.5	3.0	—	dB
	+5 volts bias	4.3	—	—	dB
—	Maximim Insertion Loss at 1000 MHz				
	+20 volts bias	2.0	2.5	—	dB
	+15 volts bias	2.5	3.0	—	dB
	+10 volts bias	3.1	3.7	—	dB
	+5 volts bias	5.2	—	—	dB
—	Input VSWR				
	Pin < +20 dBm	—	—	2.0:1	
—	Output VSWR				
	Pin < –10 dBm	—	—	2.0:1	
—	Output Level Variation vs. Temperature	—	—	±1.0	dB
—	Bias Current				
	At +20 VDC	10	—	—	mA
	At +15 VDC	7	—	—	mA

MAXIMUM RATINGS

DC Voltage .... +25.0 Volts
Continuous RF Input Power .... +26.0 dBm
Peak Input Power (3 µsec Max.) .... +30.0 dBm
Operating Case Temperature .... –54°C to +125°C
Storage Temperature .... –62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

SCHEMATIC

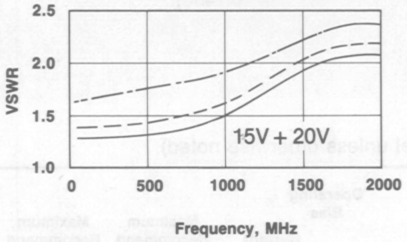


WEIGHT: (typical) 2.1 grams

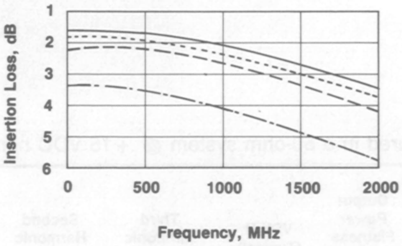
TYPICAL PERFORMANCE AT 25°C, +15 VDC (unless otherwise noted)

Bias Voltage:
5 V —·—·—
10 V — — —
15 V ---------
20 V ———

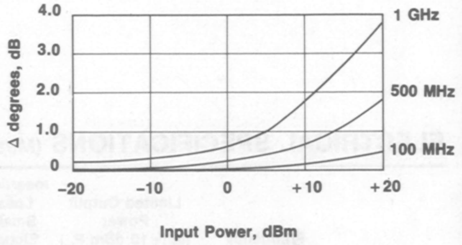
Input and Output VSWR (P$_{IN}$ = –70 dBm)



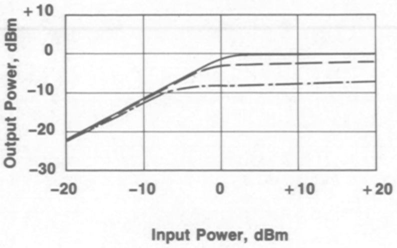
Insertion Loss (P$_{IN}$ = –20 dBm)



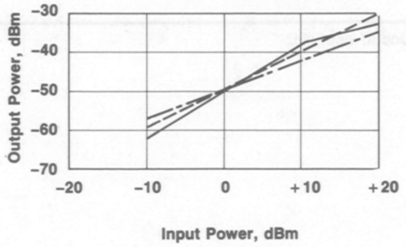
AM-PM Conversion (Bias = 10V)



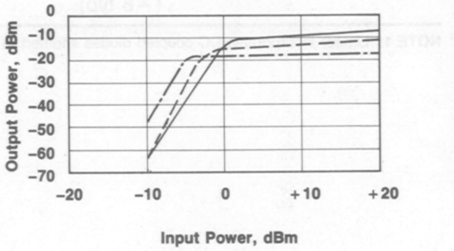
Fundamental Power f = 100 MHz



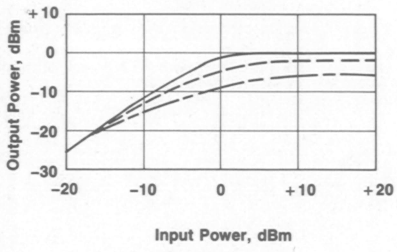
Second Harmonic Power f = 100 MHz



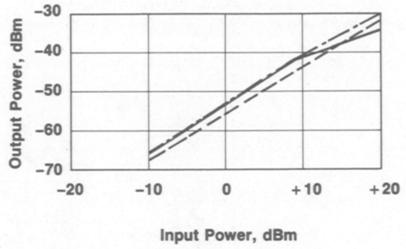
Third Harmonic Power f = 100 MHz



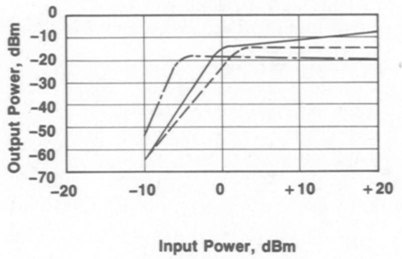
Fundamental Power f = 500 MHz



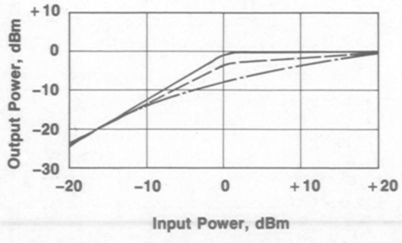
Second Harmonic Power f = 100 MHz



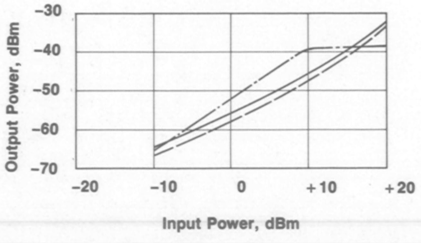
Third Harmonic Power f = 500 MHz



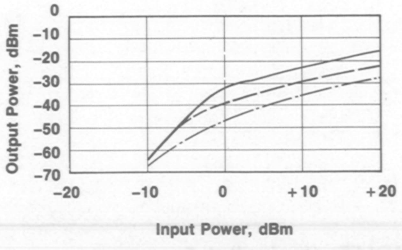
Fundamental Power f = 1000 MHz



Second Harmonic Power f = 1000 MHz



Third Harmonic Power f = 1000 MHz



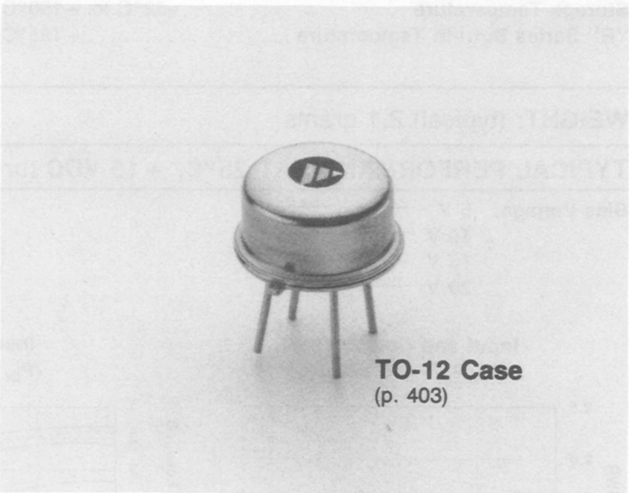
GPL-1001

Voltage Controlled Signal Limiter 5-1000 MHz

AVANTEK

FEATURES

- **Low VSWR**
- **Low AM to PM Conversion**



TO-12 Case
(p. 403)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Model GPL	Frequency Response (MHz) Minimum	Limited Output Power (@ +10 dBm P_{in}) dBm Maximum	Insertion Loss Small Signal (db) Typical	Output Power Flatness (+dB) Typical	VSWR (Typical)		Third Harmonic (dBc) Typical	Second Harmonic (dBc) Typical	Operating Bias		Maximum Recommend Input Power (dBm)	Maximum Recommend Bias (VDC)
					Input	Output			VDC Nominal	Current (mA) Typical		
1001[1]	5–1000	−4.0 (−8 typ)	5.0	1.0	2.0	2.0	12	30	+15	5	+26	+20

NOTE 1: Limiter incorporates DC coupled diodes shunted to ground at input pin.

WEIGHT: (typical) 1.5 grams

NOTES:

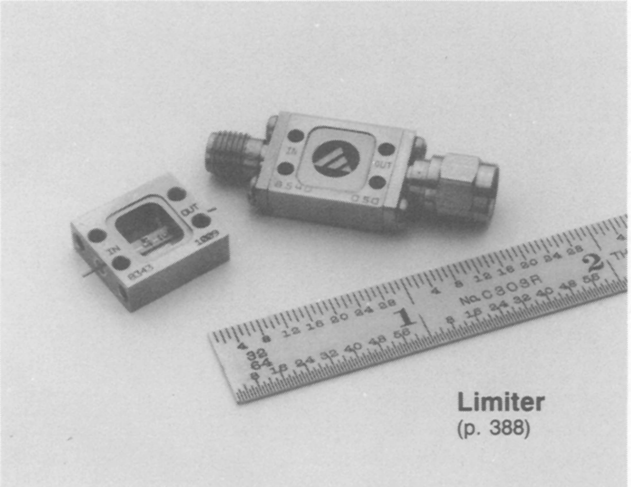
AHL-0 Series
AHL-1 Series

Thin Film Limiters 2.0-18 GHz

AVANTEK

FEATURES

- Subminiature Avanpak Package
- Full Band 2-18 GHz Performance
- All Thin Film Construction
- Laser Welded — Truly Hermetic
- Removable SMA Connectors
- Low Insertion Loss
- Low VSWR
- Low Leakage



Limiter
(p. 388)

AVANPAK™ THIN-FILM RF LIMITERS (Guaranteed Specifications at +25°C Case Temperature)

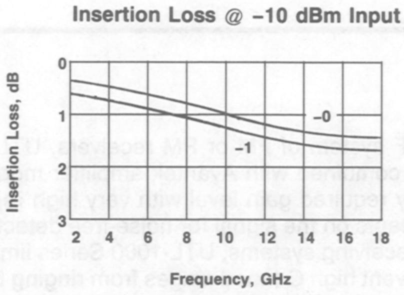
Frequency	2.0–4.0 GHz		4.0–8.0 GHz		8.0–12.0 GHz		12.0–18.0 GHz	
Model Number*	Insertion Loss (dB) Max	VSWR Max	Insertion Loss (dB) Max	VSWR Max	Insertion Loss (DB) Max	VSWR Max	Insertion Loss (dB) Max	VSWR Max
AHL0402-00X	1.0	1.8	—	—	—	—	—	—
AHL0802-00X	1.0	1.8	1.3	1.8	—	—	—	—
AHL1202-00X	1.0	1.8	1.3	1.8	1.8	1.8	—	—
AHL1802-00X	1.0	1.8	1.3	1.8	1.8	1.8	2.2	1.8
AHL0402-10X	1.4	1.8	—	—	—	—	—	—
AHL0802-10X	1.4	1.8	1.8	1.8	—	—	—	—
AHL1202-10X	1.4	1.8	1.8	1.8	2.2	1.8	—	—
AHL1802-10X	1.4	1.8	1.8	1.8	2.2	1.8	2.8	1.8

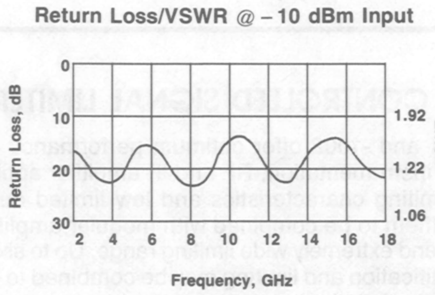
NOTES 1: All specifications at −10 dBm input power.
2: Limiting threshold +10 dBm, typical, +6 dBm minimum.
3: Flat leakage: 100 mW maximum with 200 watts peak 1.0 microsecond pulse width; 0.1% duty cycle (1000 W for −1).
4: Spike leakage: 0.1 erg maximum with 20 nanosecond risetime pulses. (0.2 erg for −1).
5: Operating temperature: −55°C to +85°C.
6: Two (2) watts maximum C.W. input power (four (4) watts for −1).

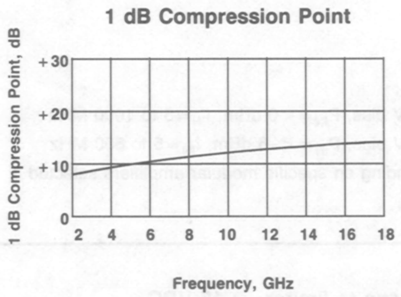
*See next page for Model Number Description.

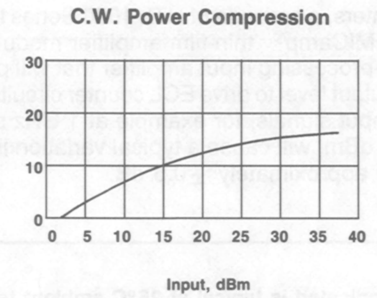
WEIGHT: (typical) With Connectors and Spacer = 10.5 grams; Without Connectors and Spacer = 5.0 grams

TYPICAL PERFORMANCE AT 25°C



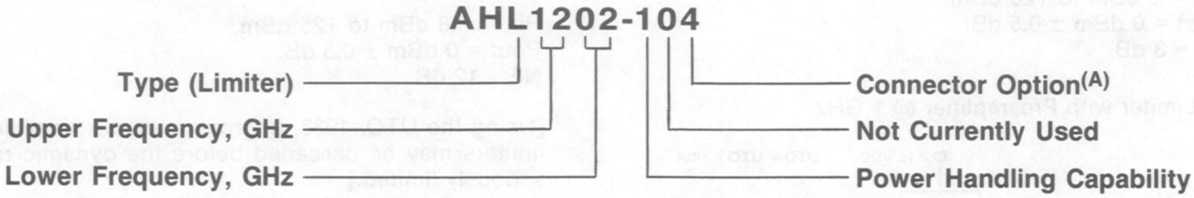






MODEL NUMBERING DESCRIPTION

TYPICAL PART NUMBER


AHL1202-104
Type (Limiter)
Upper Frequency, GHz
Lower Frequency, GHz
Connector Option(A)
Not Currently Used
Power Handling Capability

(A) CONNECTOR OPTION TABLE		
Dash No.	Input	Output
-XX1	FEM	FEM
-XX2	NONE	NONE
-XX3	MALE	MALE
-XX4	MALE	FEM
-XX5	FEM	MALE

Application Notes

VOLTAGE CONTROLLED SIGNAL LIMITERS

The UTL-1001 and -1002 offer optimum performance in a wide range of instrumentation, RF and IF amplifier applications. Their limiting characteristics and low limited output power allows them to be combined with modular amplifiers with high gain and extremely wide limiting range. Up to six*** stages of amplification and limiting may be combined to produce the required limited output power level, gain and dynamic range.

In electronic counters, a cascade of UTL-1000 Series limiters and UTO Series MICamp® thin-film amplifier modules will produce a signal-processing input amplifier that will provide a very constant output level to drive ECL counter circuits. Very wide ranges of input signals, for example at 1 GHz signals from −18 to +26 dBm, will cause a typical variation in drive to the counter of approximately ±0.5 dB.

In the IF system of FM or PM receivers, UTL-1000 Series limiters combined with Avantek amplifier modules will provide any required gain level with very high rejection of AM components on the signal for noise-free detector operation. In AM receiving systems, UTL-1000 Series limiters in the IF can prevent high Q tuned stages from ringing by preventing excessive impulse noise on the signal.

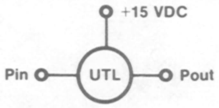
* 20.0 V bias, $P_{IN} = <0$ dBm, $f_{IN} = 5$ to 1000 MHz

** 10.0 V bias, $P_{IN} = <-6$ dBm, $f_{IN} = 5$ to 500 MHz

*** depending on specific modular amplifiers selected

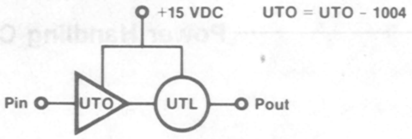
All performance indicated is typical at 25°C ambient temperature. Input voltage to limiter = +15 VDC.

A. Limiter alone. f = 1 GHz



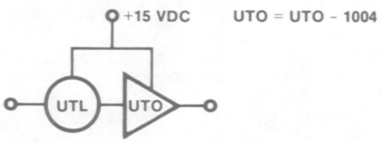
Pin = 0 dBm to +20 dBm.
Pout = 0 dBm ± 0.5 dB.
NF ≈ 3 dB

B. Limiter with Preamplifier @ 1 GHz



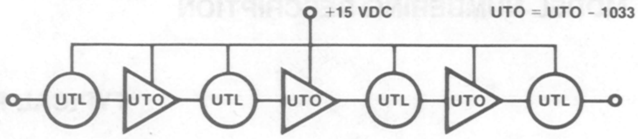
Pin = -6 dBm to +15 dBm.
Pout = 0 dBm ± 0.5 dBm.
NF ≈ 12.5 dB.

C. Limiter with Post Amplifier @ 1 GHz



Pin = 0 dBm to +20 dBm.
Pout = +10 dBm ± 1.5 dB.
NF ≈ 15 dB.

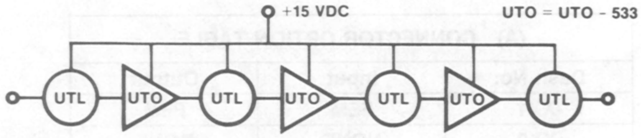
D. 1 GHz Cascade.



Pin = −18 dBm to +25 dBm.
Pout = 0 dBm ± 0.5 dB.
NF ≈ 12 dB.

[Using the UTO-1033, approximately six amplifiers and limiters may be cascaded before the dynamic range is seriously limited.]

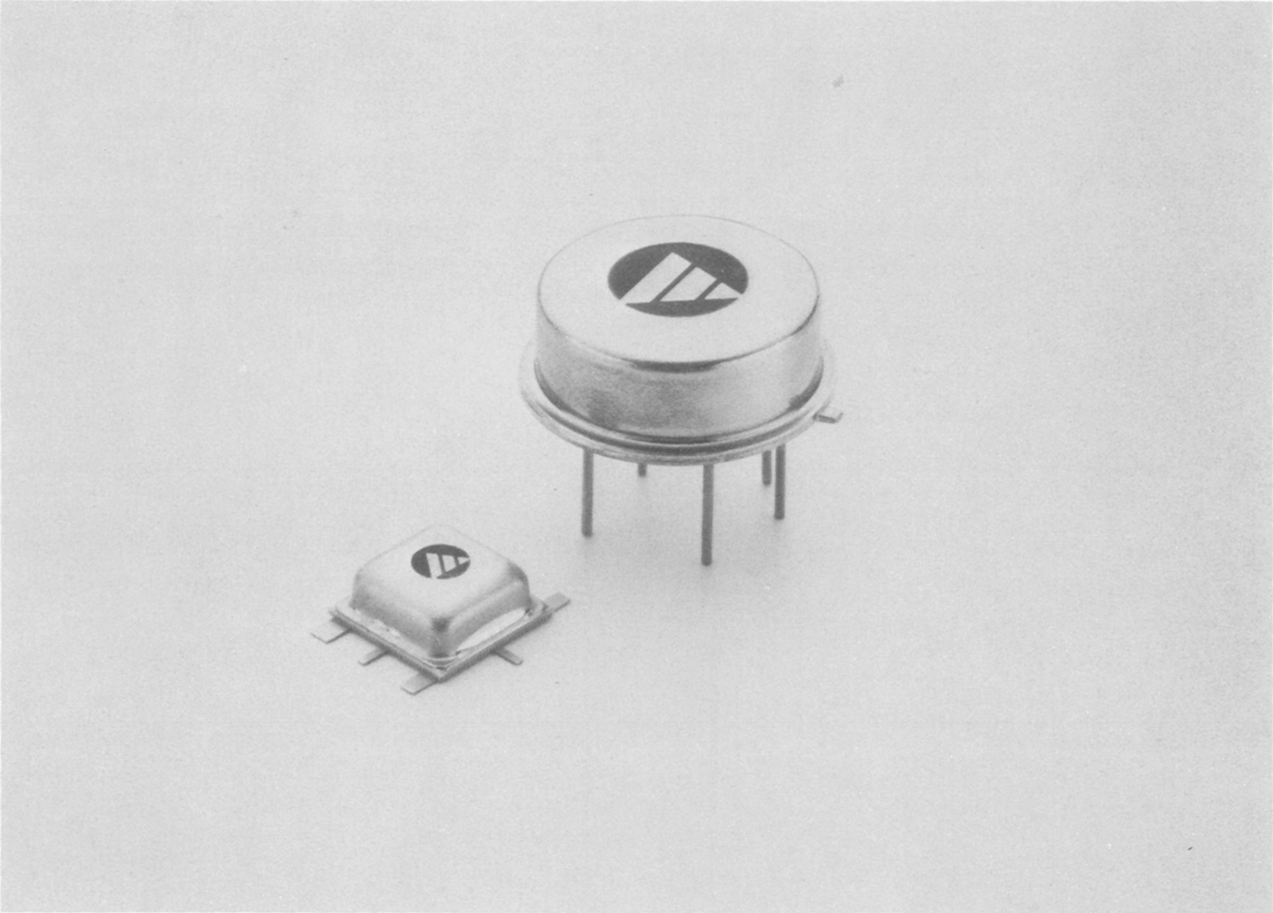
E. 500 MHz Cascade



Pin = -36 dBm to +25 dBm.
Pout = 0 dBm ± 0.5 dB.
NF ≈ 9 dB.

NOTES:

PRODUCT DATA



• ATTENUATORS

Product Description 342

Selection Guide 343

Data Sheets

- Voltage Controlled Signal Attenuators 344
- PlanarPak Voltage Controlled Attenuator 348

Application Notes 352

See Page 4 for a complete Alphanumeric Listing of Modular Products.

Product Descriptions

VOLTAGE CONTROLLED SIGNAL ATTENUATORS

The UTF Series consists of thin-film, precision, broadband voltage controlled attenuators that cover the 5 to 2000 MHz frequency range.

These attenuators have been designed to provide flexible gain control in a cascade of amplifiers. Installed near the input of a cascade, they provide the widest control range while near the output they provide the best noise figure. The consistent input and output impedance allows several modules to be cascaded for even wider attenuation range. Their long-term stability allows them to be used as trimmers to precisely match the performance of two or more amplifier cascades without frequent adjustment.

UTF attenuators are supplied in the TO-8 hermetic package.

PLANARPAK™ SURFACE MOUNT ATTENUATOR

The PPF-030 is a surface mount attenuator which covers the 100 to 2000 MHz frequency range.

This PlanarPak device is similar to the UTF-030 with the exception of the package type.

The PPF-030 is supplied in the newly designed surface mount package which allows the use of simpler microstrip installation at higher densities and improved performance.

Selection Guide

Voltage Controlled Signal Attenuators (Guaranteed Specifications @ 0° to 50°C Case Temperature)

Model	Frequency Range (MHz)	Insertion Loss, (dB) Maximum	Attenuation (dB) Minimum	Switching Speed 10 to 90% Typical%	VSWR Maximum	Control Power Typical	Input Power Typical	Page No.
UTF-025	5–500	2.5	30	75 μsec	2.0	0 to +15 VDC,	+15 VDC,	346
	5–1000	2.5	25	75 μsec	2.0	0 to 7 mA	15 mA	
	5–2000	3.3	20	75 μsec	2.5			
UTF-030	100–500	2.5	40	500 nsec	2.0	0 to +15 VDC,	+15 VDC,	348
	500–1000	3.0	35	500 nsec	2.0	0 to 10 mA	10 mA	
	1000–2000	3.5	25	500 nsec	2.0			
UTF-015	5–1000	2.0, 5–500 MHz	15	.5 msec	2.0	10 to −10 VDC,	+15 VDC,	344
		2.5, 500–1000 MHz				0 to 7 mA	7 mA	
UTF-040	10–1000	2.0, 5–500 MHz	40, 30–250 MHz	.4 msec	2.0, 10–500 MHz	0 to −12 VDC,	+15 VDC,	350
		2.5, 500–1000 MHz	35, 10–500 MHz		2.5, 10–1000 MHz	0 to 75 mA	10 mA	
			30, 10–1000 MHz					

The factory can guarantee operation over −55°C to +105°C if required.

PPF-030, Surface Mount Attenuator in PlanarPak™ Package

(Guaranteed Specifications @ 0° to +50°C Case Temperature

Model	Frequency Range (MHz)	Insertion Loss, dB Max.	Attenuation (dB), Max.	VSWR (50Ω) Max.	Switching Speed (μsec) Max.	Control Voltage (V)	Page No.
PPF-030	100–500	2.5	40	2.0	1.0	0 to +15	348
	500–1000	3.0	35	2.0	1.0		
	1000–2000	3.5	25	2.0	1.0		

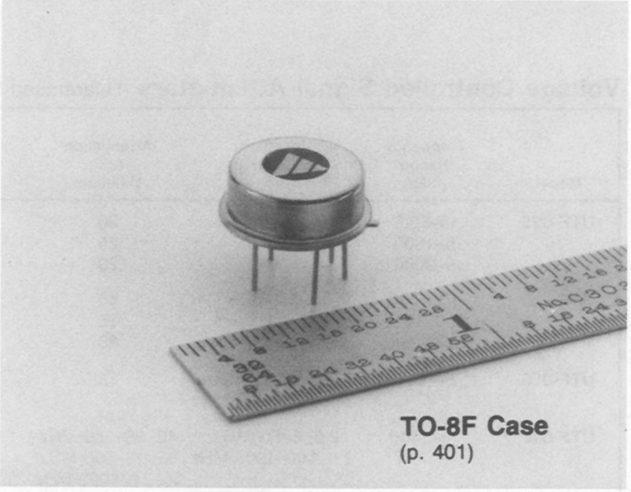
UTF-015

Attenuator
5-1000 MHz

AVANTEK

FEATURES

- <1.6:1 VSWR
- **20 dB of Attenuation**
- **Negative Control Voltage**



TO-8F Case
(p. 401)

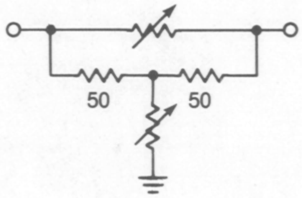
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system at +15 VDC nominal)

Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		$T_C = 25°C$	$T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	
BW	Frequency Range	5–1000	5–1000	5–1000	MHz
—	Attenuation, Min. ($V_C = -10$ V)	20.0	15.0	—	dB
—	Insertion Loss, Max. ($V_C = 0$ V)				
	5–500 MHz	1.5	2.0	—	dB
	500–1000 MHz	2.0	2.5		db
—	VSWR (Worst Case in Attenuation Range)	1.5:1	2.0:1	—	—
—	Flatness Over Frequency	±.5	—	—	dB
—	Switching Speed (10% to 90%) (ON to OFF or OFF to ON)	.5	—	—	msec
—	Bias Current	7	—	—	mA
—	Control Voltage	0 to −10	0 to −10	—	VDC
—	Control current	0 to 7	—	—	mA

MAXIMUM RATINGS

DC Voltage .... +17/−15 Volts
Continuous RF Input Power .... +23.0 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

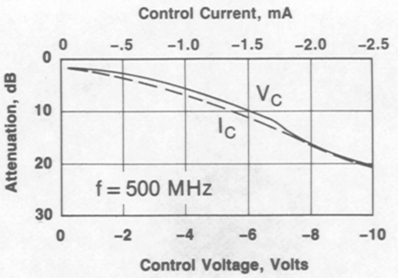
SCHEMATIC



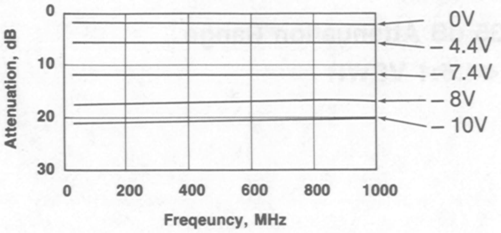
WEIGHT: (typical) 2.1 grams

TYPICAL PERFORMANCE AT 25°C

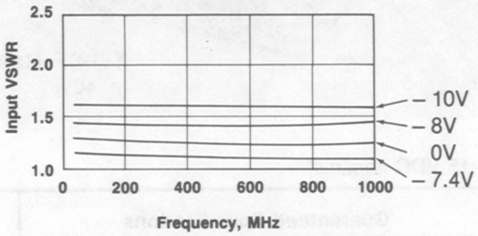
Attenuation



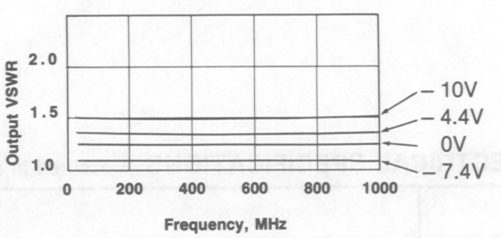
Attenuation



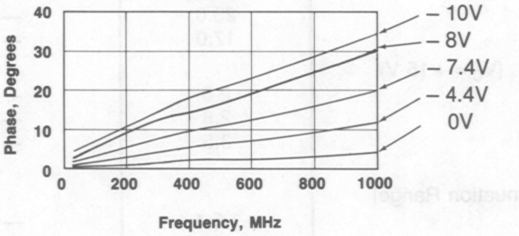
Input VSWR



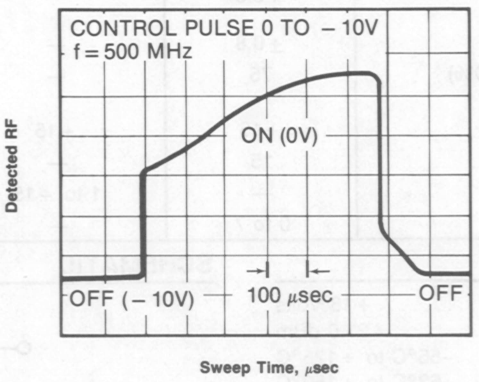
Output VSWR



Phase



Switching Time



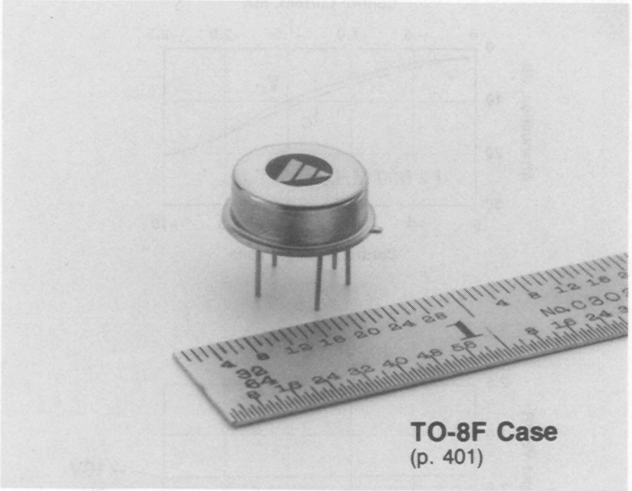
UTF-025

Attenuator
5-2500 MHz

AVANTEK

FEATURES

- **35 dB Attenuation Range**
- **<1.5:1 VSWR**



TO-8F Case
(p. 401)

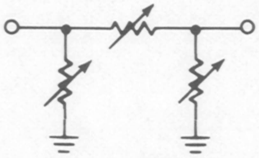
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system at +15 VDC nominal)

Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		$T_C = 25°C$	$T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	
BW	Frequency Range	5–2500	5–2000	5–2000	MHz
—	Attenuation, Min. ($V_C = 0$ V)				
	5–500 MHz	33.0	—	30.0	dB
	500–1000 MHz	28.0	—	25.0	dB
	1000–2000 MHz	23.0	—	20.0	dB
	2000–2500 MHz	17.0	—	—	dB
—	Insertion Loss, Max. ($V_C = +15$ V)				
	5–1000 MHz	2.0	—	2.5	dB
	1000–2000 MHz	2.8	—	3.3	db
	2000–2500 MHz	3.5	—	—	dB
—	VSWR (Worst Case in Attenuation Range)				
	5–1000 MHz	1.5:1	—	2.0:1	—
	1000–2000	1.8:1	—	2.5:1	—
—	Intercept Point	+30	—	—	dBm
—	Flatness Over Frequency (Min. to 15 dB)				
	5–1000 MHz	±0.4	—	±0.75	dB
	1000–2000 MHz	+0.6	—	±1.00	dB
	(Min. to 20 dB)				
	5–1000 MHz	±0.8	—	±1.2	dB
—	Switching Speed (10% to 90%) (ON to OFF or OFF to ON)	75	—	—	μsec
—	Bias Voltage	+15	+15	+15	VDC
—	Bias Current	15	—	—	mA
—	Control Voltage	—	1 to +15	1 to +15	VDC
—	Control current	0 to 7	—	—	mA

MAXIMUM RATINGS

DC Voltage .... +18 Volts
Continuous RF Input Power .... +23.0 dBm
Operating Case Temperature .... -55°C to +125°C
Storage Temperature .... -62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

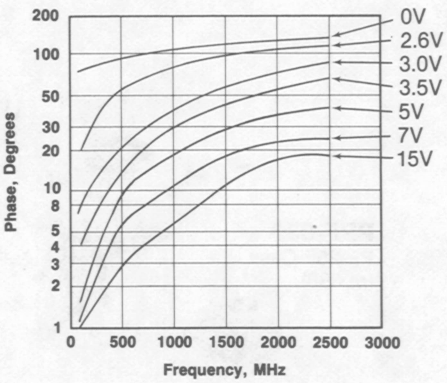
SCHEMATIC



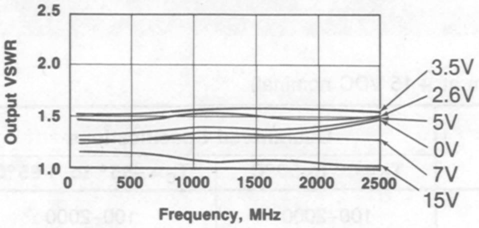
WEIGHT: (typical) 2.1 grams

TYPICAL PERFORMANCE AT 25°C

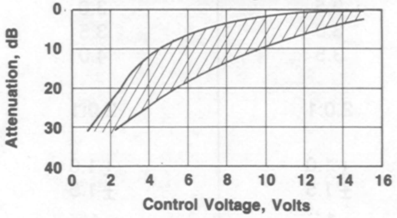
Phase



Output VSWR

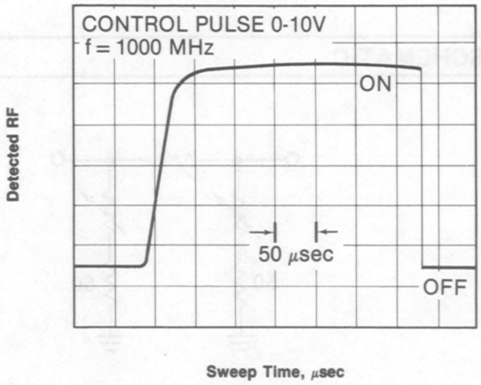


Variations of Attenuation From Unit to Unit at Various Control Voltages at 1000 MHz

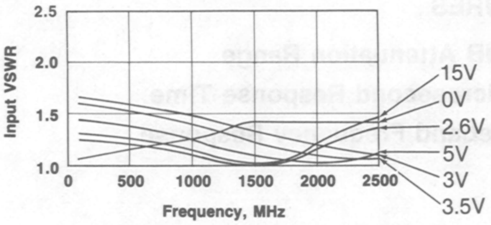


Due to R_S vs. I_F differences in pin diodes used in this product, internal drive compensation is done to optimize VSWR. This correction can affect the Attenuation vs. Control Voltage from unit to unit to the extent shown in the graph.

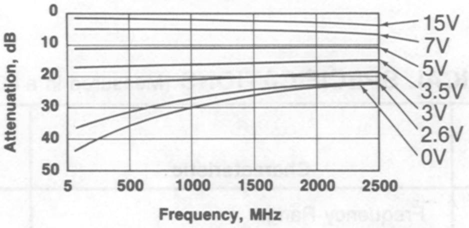
Switching Time



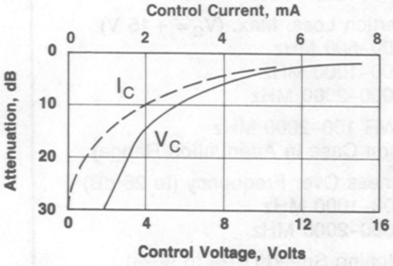
Input VSWR



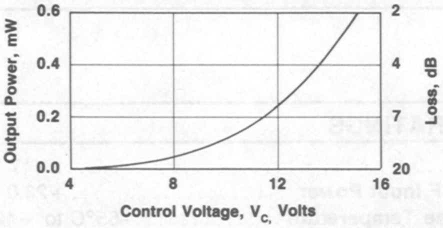
Attenuation



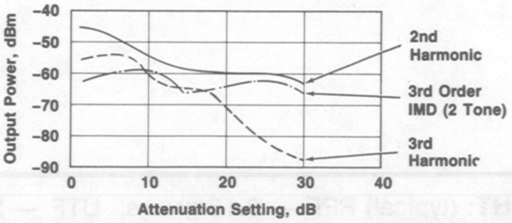
Attenuation



Output Power and Loss (Input Signal 0 dBm [1 mW], $F_{IN} = 5$ MHz)



Distortion Products (Input Signal 0 dBm, $f_{IN} = 5$ MHz)



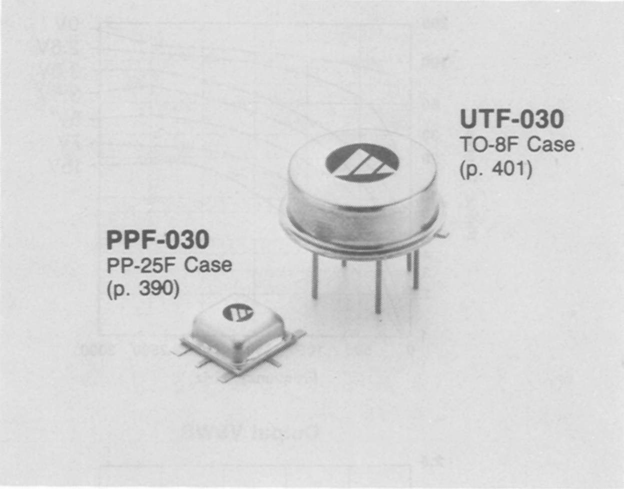
030 Series

Attenuator
100-2000 MHz

AVANTEK

FEATURES

- **40 dB Attenuation Range**
- **1 Microsecond Response Time**
- **Wideband Frequency Response**



UTF-030
TO-8F Case
(p. 401)

PPF-030
PP-25F Case
(p. 390)

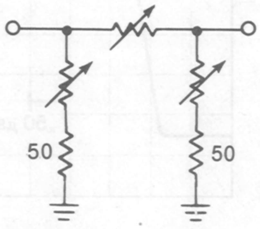
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system at +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	Guaranteed Specifications $T_C = -55°$ to $+85°C$	Unit
BW	Frequency Range	100–2300	100–2000	100–2000	MHz
—	Attenuation, Min. ($V_C = 0$ V)				
	100–500 MHz	45	40	40	dB
	500–1000 MHz	40	35	35	dB
	1000–2000 MHz	30	25	25	dB
—	Insertion Loss, Max. ($V_C = +15$ V)				
	100–500 MHz	2.0	2.5	3.0	dB
	500–1000 MHz	2.5	3.0	3.5	db
	1000–2000 MHz	3.0	3.5	4.0	dB
—	VSWR 100–2000 MHz (Worst Case in Attenuation Range)	1.7:1	2.0:1	2.0:1	—
—	Flatness Over Frequency (to 25 dB)				
	100–1000 MHz	0.5	±1.0	±1.0	dB
	1000–2000 MHz	±1.0	±1.5	±1.5	dB
—	Switching Speed (10% to 90%) (ON to OFF or OFF to ON)	.5	1	1	μsec
—	Bias Current	8.0	—	—	mA
—	Control Voltage	0 to +15	—	—	VDC
—	Control current	0 to 10	—	—	mA

MAXIMUM RATINGS

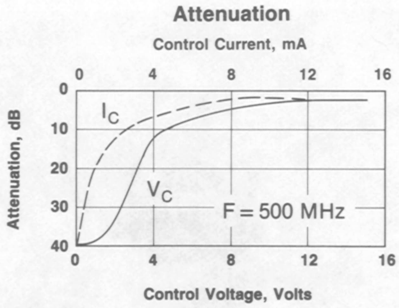
DC Voltage	+17 Volts
Continuous RF Input Power	+23.0 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

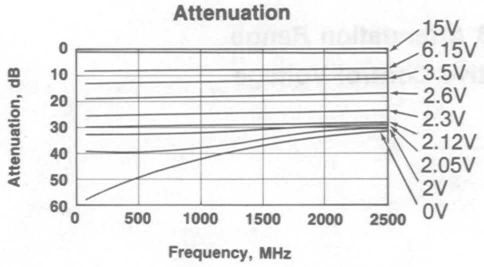
SCHEMATIC

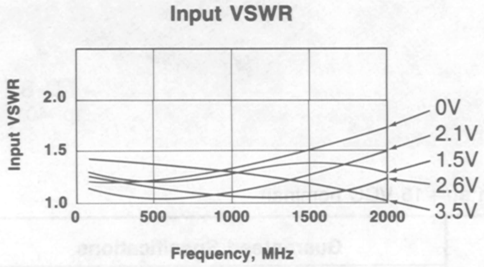


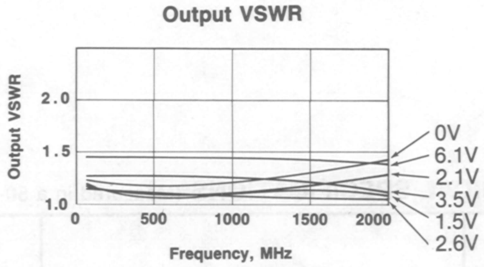
WEIGHT: (typical) PPF — 0.15 grams; UTF — 2.1 grams

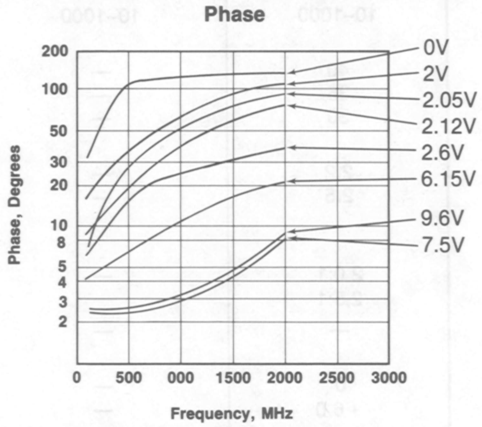
TYPICAL PERFORMANCE @ 25°C TEMPERATURE (at +15 VDC unless otherwise noted)

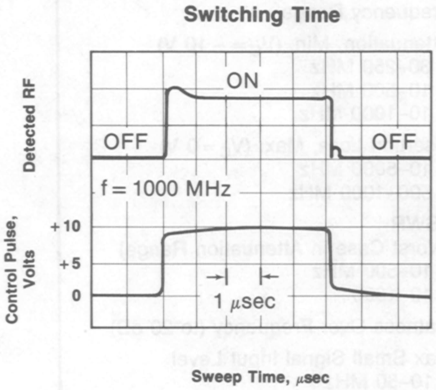

Attenuation


Attenuation


Input VSWR


Output VSWR


Phase


Switching Time

UTF-040

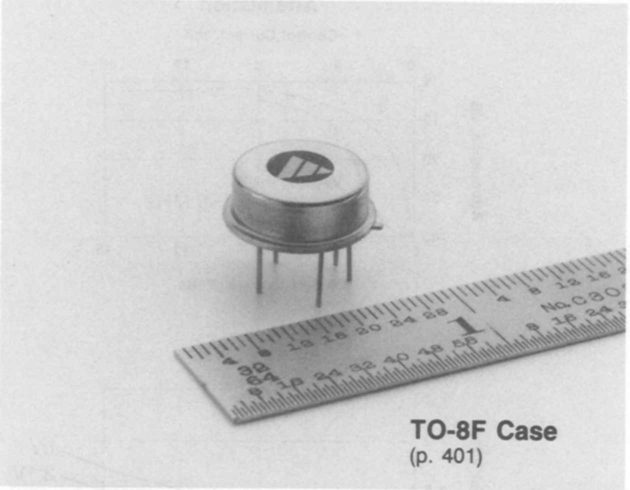
Attenuator

10-1000 MHz

AVANTEK

FEATURES

- **40 dB Attenuation Range**
- **Negative Control Voltage**



TO-8F Case
(p. 401)

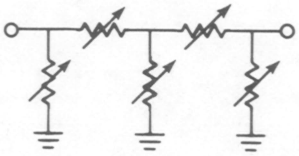
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system at +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	Guaranteed Specifications $T_C = -55°$ to $+85°C$	Unit
BW	Frequency Range	10–1000	10–1000	10–1000	MHz
—	Attenuation, Min. ($V_C = -10$ V)				
	30–250 MHz	—	40	—	dB
	10–500 MHz	—	35	—	dB
	10–1000 MHz	—	30	—	dB
—	Insertion Loss, Max. ($V_C = 0$ V)				
	10–5000 MHz	—	2.2	—	dB
	500–1000 MHz	—	2.5	—	db
—	VSWR (Worst Case in Attenuation Range)				
	10–500 MHz	—	2.0:1	—	—
	10–1000	—	2.5:1	—	—
—	Flatness Over Frequency (to 20 dB)	±0.5	—	—	dB
—	Max Small Signal Input Level				
	10–50 MHz	—	0	—	dBm
	50—1000 MHz	—	+6.0	—	dBm
—	Switching Speed (10% to 90%) (ON to OFF or OFF to ON)	.4	—	—	msec
—	Bias Voltage	+15	+15	—	VDC
—	Bias Current	10	10	—	mA
—	Control Voltage	0 to −12	0 to −12	—	VDC
—	Control current	0 to 75	0 to 75	—	mA

MAXIMUM

DC Voltage .... +17 Volts
Continuous RF Input Power .... +23.0 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

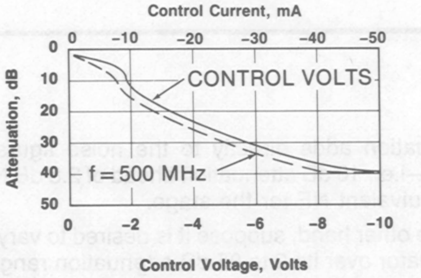
SCHEMATIC



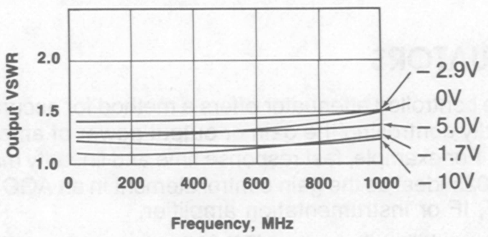
WEIGHT: (typical) 2.1 grams

TYPICAL PERFORMANCE AT +15 VDC

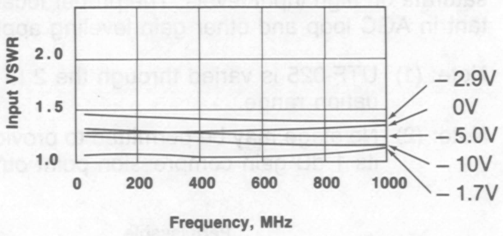
Attenuation



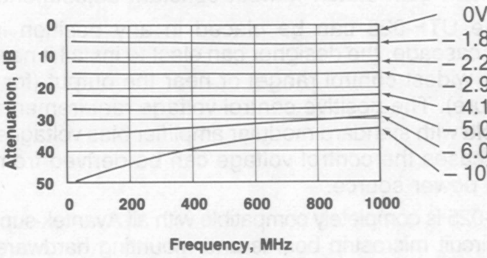
Output VSWR



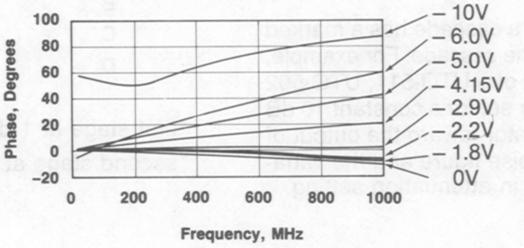
Input VSWR



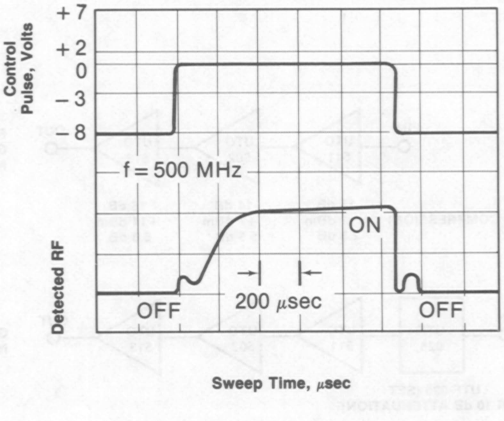
Attenuation



Phase



Switching Time



Application Notes

ATTENUATORS

A voltage controlled attenuator offers a method for accurately and rapidly controlling the gain or output power of amplifier cascade. For example, fast response time and linearity makes the UTF-025 ideal as the gain control element in an AGC loop in an RF, IF or instrumentation amplifier.

Long term stability allows the UTF-025 to be used as a "trimmer" to precisely match the performance of two or more amplifier cascades and, with a well-regulated control voltage, will maintain gain match without constant adjustment.

Since the UTF-025 can be placed in any position in an amplifier cascade, the designer can elect to install it near the input (for widest control range) or near the output (for best noise figure). The positive control voltage requirements are compatible with standard modular amplifier bias voltages and in many cases the control voltage can be derived from the common power source.

The UTF-025 is completely compatible with all Avantek-supplied printed circuit microstrip boards and mounting hardware.

DESIGN EXAMPLE

Noise Figure Effects

The position of a UTF attenuator in a cascade has a marked effect on the overall noise figure of the cascade. For example, in the following cascade consisting of a UTO-511, UTO-502 and UTO-513 MICamp® attenuator set for a constant 10 dB of attenuation. Locating the attenuator toward the output of the cascade reduces the overall noise figure and the variations in noise figure with changes in attenuation setting.

F_N = Noise Factor of stage.,

NF = Noise Figure in dB

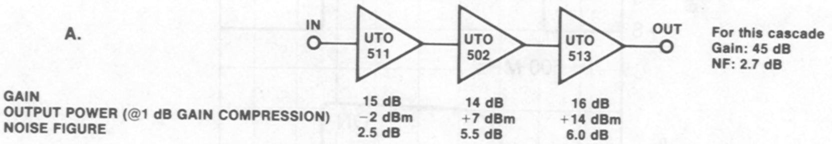
G = relative gain

$$F_N \text{ cascade} = F_{N_1} + \frac{F_{N_2}-1}{G_1} + \frac{F_{N_3}-1}{G_1G_2} + \cdots \frac{F_{N_n}-1}{G_1 \ldots G_n}$$

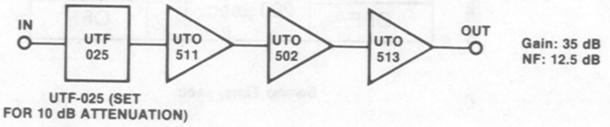
$$NF = 10 \log F_n$$

$$F_N = \log^{-1}\frac{NF\ (dB)}{10}, G = \log^{-1}\frac{Gain\ (dB)}{10}$$

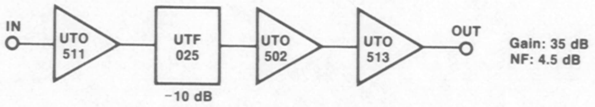
A.


IN
UTO 511
UTO 502
UTO 513
OUT
For this cascade
Gain: 45 dB
NF: 2.7 dB
GAIN
OUTPUT POWER (@1 dB GAIN COMPRESSION)
NOISE FIGURE
15 dB
−2 dBm
2.5 dB
14 dB
+7 dBm
5.5 dB
16 dB
+14 dBm
6.0 dB

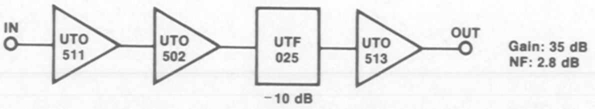
B.


IN
UTF 025
UTO 511
UTO 502
UTO 513
OUT
Gain: 35 dB
NF: 12.5 dB
UTF-025 (SET
FOR 10 dB ATTENUATION)

C.


IN
UTO 511
UTF 025
UTO 502
UTO 513
OUT
Gain: 35 dB
NF: 4.5 dB
−10 dB

D.


IN
UTO 511
UTO 502
UTF 025
UTO 513
OUT
Gain: 35 dB
NF: 2.8 dB
−10 dB

Attenuation adds directly to the noise figure of the next stage—i.e., 10 dB attenuation ahead of 2.5 dB N stage = 12.5 dB equivalent NF for the stage.

On the other hand, suppose it is desired to vary the UTF-025 attenuator over its 2 to 35 dB attenuation range to maintain a constant output power from the same cascade. Locating the attenuator toward the input port of the cascade controls the signal power level applied to the entire cascade, while moving it toward the output will permit earlier stages to saturate on high input levels. The proper location is important in AGC loop and other gain leveling applications.

Note: (1) UTF-025 is varied through the 2 to 35 dB attenuation range.

Note: (2) No stage may be permitted to provide more than its 1 dB gain compression point output power.

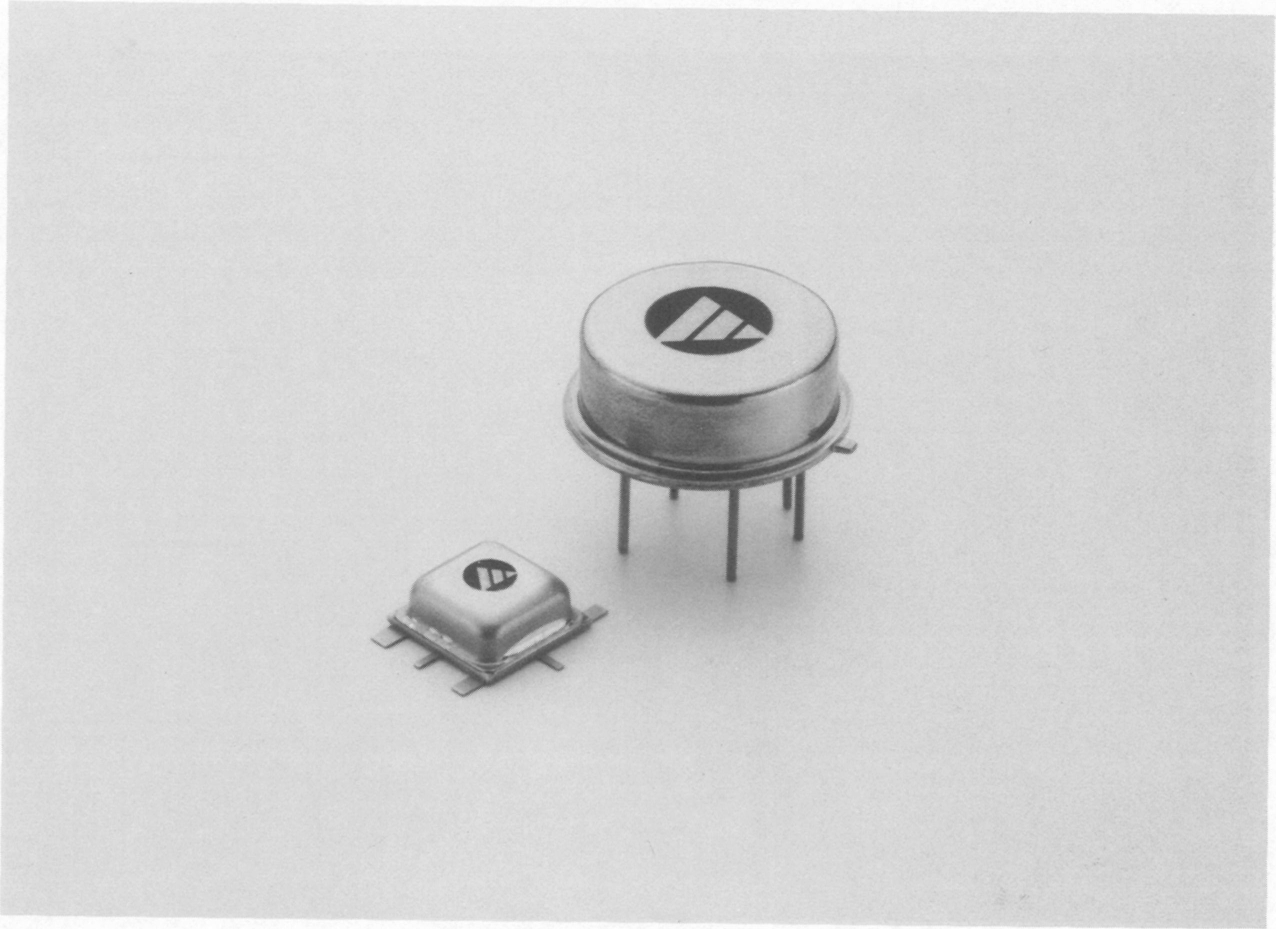
Cascade	Permissable Input Power Levels	Dynamic Range
A	−31 dBm only	(0 dB range)
B	−29 to +4 dBm	(33 dB range)
C	−29 to −17 dBm*	(12 dB range)
D	−29 to −22 dBm**	(7 dB range)

*first stage at 1 dB gain compression point

**second stage at 1 dB gain compression point

NOTES:

PRODUCT DATA



Product Descriptions 356

Selection Guide 357

Data Sheets

- Voltage Controlled Level Detectors 358
- PlanarPak Voltage Controlled Level Detector 360
- Voltage Controlled Threshold Detector 362

Application Notes 364

See Page 4 for a complete Alphanumeric Listing of Modular Products.

Product Descriptions

VOLTAGE CONTROLLED LEVEL DETECTORS

The UTD Series of level detectors covers the 10 to 1000 MHz frequency range.

These thin-film level detectors consist of an active high-to-low impedance converter driving Schottky-barrier detector diodes, with matched "back-to-back" diodes closely-coupled to the detector diode to provide a DC tracking reference.

The UTD-1000 has a 50-ohm input impedance for broadband applications, and the UTD-1001 offers a high input impedance, particularly suitable for direct sampling in narrowband applications.

UTD level detectors are offered in the TO-8 hermetic package.

PLANARPAK™ SURFACE MOUNT LEVEL DETECTORS

The PPD—2001 is a surface mount level detector which covers the 20 to 2000 MHz frequency range.

This PlanarPak detector features a low VSWR and is temperature compensated—output is stable over temperature.

The PPD-2001 is supplied in the newly designed surface mount package which allows the use of simpler microstrip installation at higher densities and improved performance.

VOLTAGE CONTROLLED THRESHOLD DETECTOR

The UTD-2002 is a threshold detector which covers the 10 to 2000 MHz frequency range.

This threshold detector offers low VSWR and is TTL output compatible. The threshold is setable at an input range of –10 to +10 dBm.

The UTD-2002 is recommended for use as a digital threshold detector or built-in test detector or where small size is a requirement.

This unit is offered in a TO-8 hermetic package.

Selection Guide

Voltage Controlled Level Detectors (Guaranteed Specifications @ 25°C Case Temperature)

Model	Frequency Range (MHz)	Detected Voltage at P_{IN} = −10 dBm (mV), Typ.	Flatness (dB), Max.	Sensitivity w/BW = 1 MHz (dB)	Tangential Input Impedance (ohms)	Input VSWR Max.	Output Offset Voltage (mV), Typ.	Differential Voltage Tracking (mV), Typ.	Page No.
UTD-1000	10–1000	−90	±1.0	−40	50	1.7:1	±15	±5	358
UTD-1001	10–1000	−90	±1.0	−40	300	—	±15	±5	358

PPD-2001, Surface Mounted Level Detector (Guaranteed Specifications @ 25°C Case Temperature

Model	Frequency Range (MHz)	VSWR (50Ω), Max.	Sensitivity (V/mW), Typ.	Flatness (@ Input) (dB), Max.	Video B/W (kHz), Typ.	Power (VDC), Nom.	Page No.
PPD-2001	20–2000	1.8	.9	±.3	150	±15	360

Threshold Detector, TTL Output Compatible (Guaranteed Specifications @ 25°C Case Temperature)

Model	Frequency Range (MHz)	Input Flatness (dB), Max. P_{IN} = −10 to +10 dBm	Input Operating Range (dBm), Typ.	Input VSWR Max.	Threshold Control Level Typ.	Supply Voltage Range Min./Max.	Supply Current at +15 Volts (mA) Max.	Page No.
UTD-2002	10–2000	±0.7	−10 to +10	1.7:1	0–1 Volt/ 300–3k ohms	+11 to +16 V	12	362

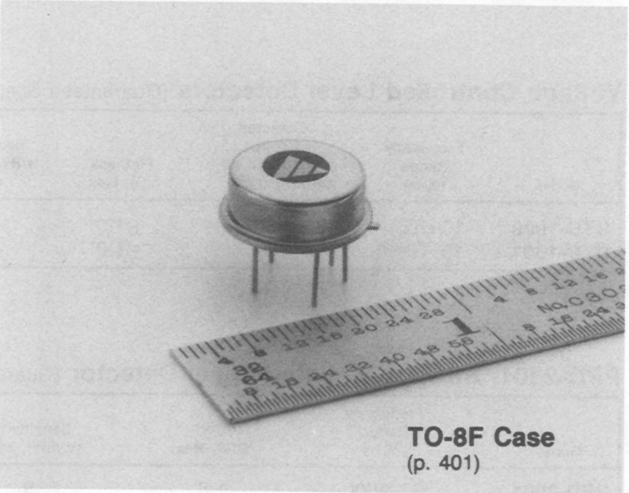
UTD-1000/1001

Level Detectors
10-1000 MHz

AVANTEK

FEATURES

- **−120 mV Output for −10 dBm Pin**
- **±1.0 dB Flatness (referenced to the input)**



TO-8F Case
(p. 401)

DESCRIPTION

The UTD-1000 has an input impedance of 50 ohms. The UTD-1001 has an input impedance of greater than 300 ohms. In all other respects the detectors are similar. The level detector consists of an active high to low impedance converter that drives a Schottky-barrier detector diode. Matched back-to-back silicon diodes which are closely thermally-coupled to the detector provide a DC tracking reference.

ELECTRICAL SPECIFICATIONS (Measured at +15 VDC nominal)

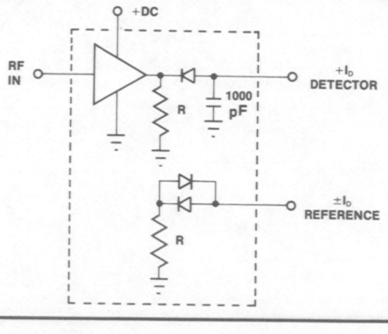
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			$T_C = 0°$ to $25°C$	$T_C = -54°$ to $+85°C$	
—	Detected Voltage f = 500 MHz, cond. 1,2	−120	−90 min		mV
—	Flatness (referred to input) f = 10–1000 MHz, cond. 1,2	±.7	±1.0 max		dB
—	Variation Over Temperature (referred to input) f = 500 MHz, cond. 1,2	±1.0			dB
—	Tangential Sensitivity (TSS) f = 500 MHz, $BW_{video} = 1$ Mhz, cond. 1	−45	−40 min		dB
—	Input VSWR, 50Ω (UTD-1000 only) f = 10–500 MHz	1.5:1	1.7:1 max		—
—	Input Impedance (UTD-1001 only) Equivalent resistance Equivalent capacitance	300 Ω 3.3 pf			
—	Input 3rd Order Intercept Point f = 10–500 MHz	+20			dBm
—	Output Offset Voltage $I_D = I_{REF} = 50\mu A$, no RF drive	±10.0	±15.0		mV
—	Differential Voltage Tracking			±5.0	mV
—	Output Capacitance	1000	1300		pf

CONDITION 1: $I_D = 50\ \mu A$, $R_L = 10\ K\mu$
CONDITION 2: Pin = −10 dBm (RF input)

MAXIMUM RATINGS

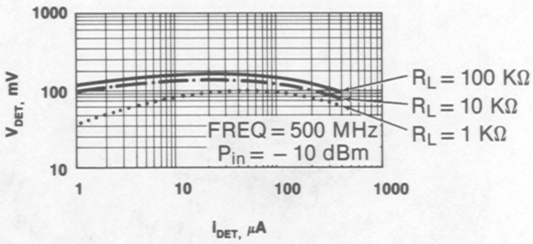
Bias Current (diode)	+1 mA
Continuous RF Input Power	+17.0 dBm
Operating Case Temperature	−54°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C
Pulse Input Power (1.0 minute max.)	100 mW

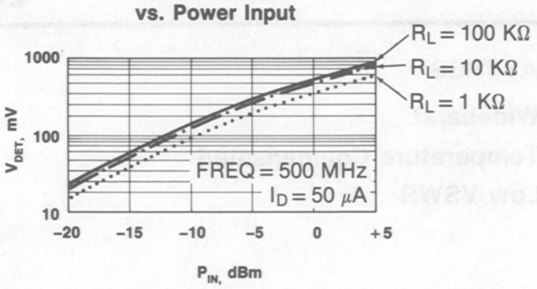
SCHEMATIC

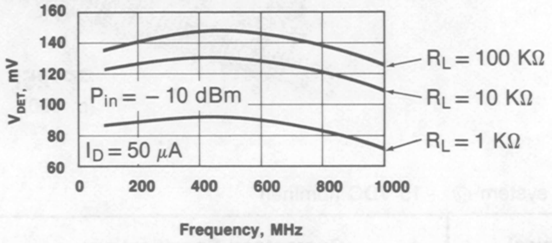


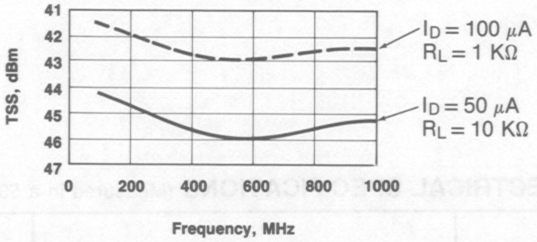
WEIGHT: (typical) 2.1 grams

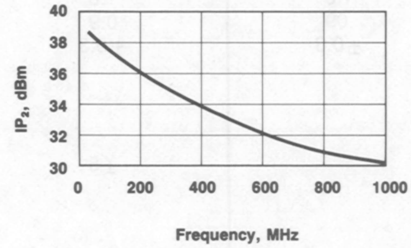
TYPICAL PERFORMANCE AT 25°C

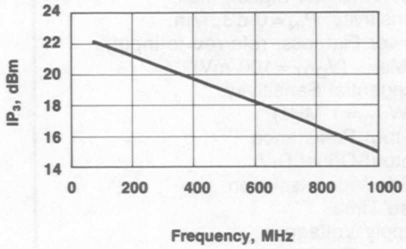

Detected Output vs. Diode Bias Current


Detected Output vs. Power Input


DC Output


Tangential Signal Sensitivity


Second Order Two-Tone* Intercept Point


Third Order Two-Tone* Intercept Point

*Distortion Curves relative to the UTD-1001 operated in shunt with a 50Ω RF line. (See applications on page 364).

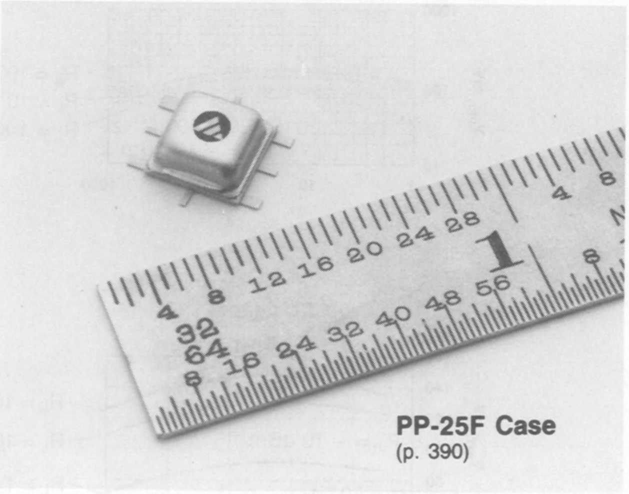
PPD-2001

Surface Mount Analog Detector 20-2000 MHz

AVANTEK

FEATURES

- **Wideband**
- **Temperature Compensated**
- **Low VSWR**



PP-25F Case
(p. 390)

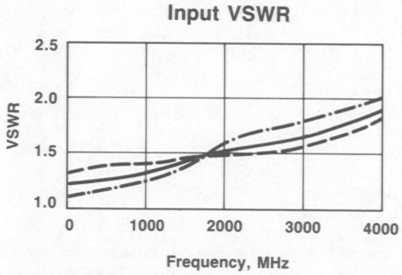
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	Unit
BW	Frequency	20–2000	20–2000	20–2000	MHz
	VSWR (Small Signal) Max.	1.5	1.8	1.8	V
	Sensitivity, $P_{IN} = 0$ dB, Min.	1.0	.09	0.9	dB
	Power Flatness, referred to input, Max., ($V_{OUT} = 100$ mV)	±0.1	±0.3	±0.3	dB
	Tangential Sensitivity ($BW_{VID} = 1$ MHz)	−38			dBm
	Output Resistance	15			ohms
	Output Offset Drift	±5		±5	mV
	RF to Video Isolation	40			dB
	Rise Time	2.0			µsec
	Supply Voltage	±15			VDC
	Supply Current	2.0			mA

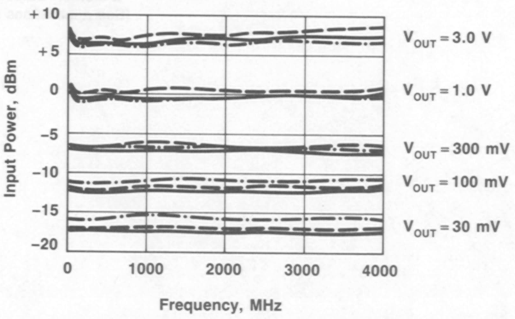
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C — — —
+85°C — — — —
−55°C ———

Input VSWR



Input Power



MAXIMUM RATINGS

DC Voltage .... ±22 Volts
Continuous RF Input Power .... +20 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

Temperature Rise (no load) .... 9°C
Temperature Rise (output short circuit) .... 30°C

*For further information, see High Reliability section.

WEIGHT: (typical) .21 grams

NOTES:

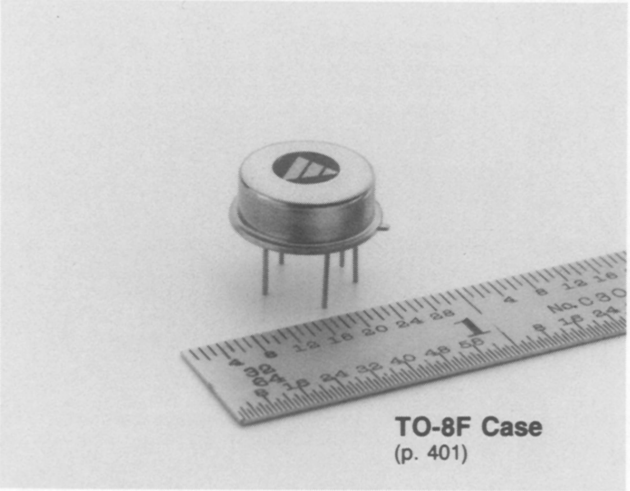
UTD-2002

Threshold Detectors
10-2000 MHz

AVANTEK

FEATURES

- **Externally Set Threshold**
- **TTL Output**
- **Low VSWR**
- **20 dB Threshold Range**



TO-8F Case
(p. 401)

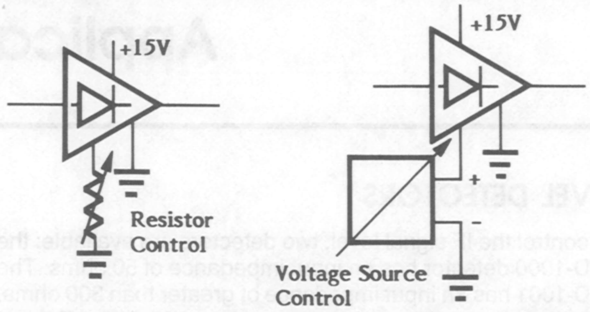
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		$T_C=25°C$	$T_C=0°$ to $50°C$	$T_C=-55°$ to $+85°C$	
—	Frequency, Min.	10-2000	10-2000	10-2000	MHz
—	Input Flatness, Max. $P_{IN}=-10$ to $+10$ dBm	±.5	±.7	±1.0	dB
—	Input Operating Range	-10 to +10	—	—	dBm
—	Input VSWR, Max.	1.3:1	1.7:1	2.0:1	—
—	Input Power, Max.	+15	+15	+15	dBm
—	Threshold Temp. Max.				
	@ −10 dBm Input Power		±1.0	±1.5	
	@ 0 dBm Input Power		±0.7	±1.0	dB
	@ +10 dBm Input Power		±0.5	±0.7	
—	Threshold Control Level				
	@ −10 dBm Input Power	90 mV/300	—	—	
	@ 0 dBm Input Power	280 mV/900	—	—	ohm
	@ +10 dBm Input Power	900 mV/2900	—	—	
—	Threshold Hysteresis, Max.				
	Resistance Control	1.0	—	—	dB
	Voltage Control	0.1	—	—	dB
—	Control Terminal Current	0.3	—	—	mA
—	Output Compatibility	TTL	TTL	TTL	—
—	Output at P_{IN} Threshold, Min.	2.7	2.7	2.7	V
—	Output Short Circuit Current, Min.	3.0	3.0	3.0	mA
—	Output Sink Current, Min., V_O 0.7 V	2.0	2.0	2.0	mA
—	Output for Input Power Change				
	C_L = 15 pF	3	—	—	dB
	Rise Time	30	—	—	nsec
	Fall Time	80	—	—	nsec
	Propogation Delay	1000	—	—	nsec
—	Supply Voltage				
	As Specified	+15	—	—	V
	Operational	+11 to +16	—	—	V
—	Supply Current @ +15 Volts	12	15	15	mA

MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+15.0 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C
DC Voltage Reference	+12 Volts

SCHEMATIC

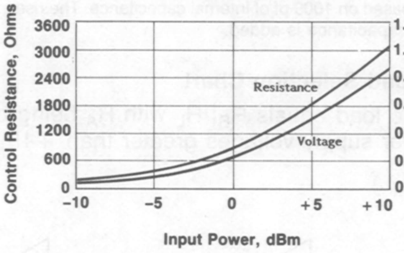

+15V
+15V
Resistor
Control
+
−
Voltage Source
Control

WEIGHT: (typical) 2.1 grams

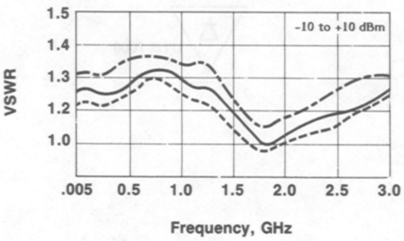
TYPICAL PERFORMANCE AT 25°C

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—

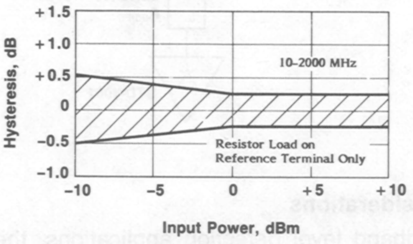
Control Voltage & Resistance vs. Input Power



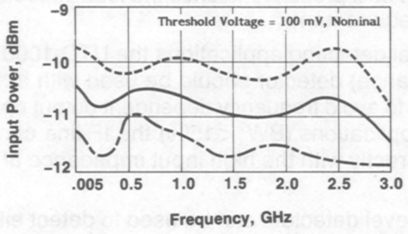
Input VSWR



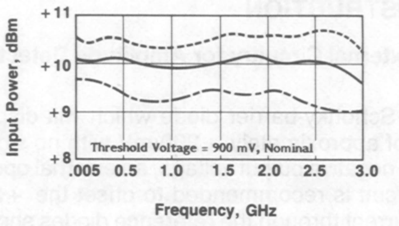
Hysteresis



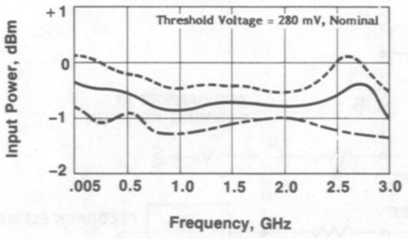
Flatness



Flatness



Flatness



Application Notes

LEVEL DETECTORS

To control the IF signal level, two detectors are available: the UTD-1000 detector has an input impedance of 50 ohms. The UTD-1001 has an input impedance of greater than 300 ohms. Both have a frequency response 10 to 500 MHz. Typical detected voltage sensitivity is –120 mV. Output variation over the temperature range –55 to +85°C is less than ±1.0 dB. Tangential sensitivity with a 1.0 MHz window is typically –45 dB.

The level detector consists of an active high to low impedance converter driving a Schottky-barrier detector diode. Matched "back-to-back" closely thermally coupled to the detector diode provide a DC tracking reference.

The bias current for the detector diode can be adjusted with a dropping resistor from the DC supply voltage. The amount of current can be selected to optimize the dynamic video source impedance so it properly matches the load impedance and bandwidth requirement.

In broadband level detecting applications the UTD-1000 (50 ohm input impedance) detector should be used with a high directivity coupler to avoid frequency dependent output ripple. In narrowband applications (BW <15%) the IF line can be easily sampled directly with the high input impedance of the UTD-1001.

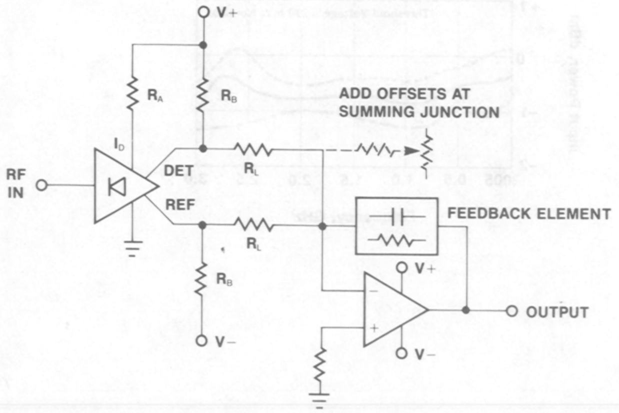
The UTD Series level detectors can be used to detect either the peak or average amplitude of a signal, as a system test point for threshold or alarm detection, in conjunction with the Avantek UTF Series of pin diode attenuators for AGC, ALC, linear modulation, or linearity extension.

OPERATING INSTRUCTION

Recommended External Circuitry for Amplitude Detection Application.

The detector is a Schottky-barrier diode which will display an offset voltage of approximately +200 mV with no signal input. To provide a negative output voltage, an external operational amplifier circuit is recommended to offset the +200 mV to zero. The current through the reference diodes should be set to the same value as the bias current through the detector diode to provide best temperature tracking.

Figure 1.



Average envelope detection will result when operating the detector in its square-law region with adequate video filtering (Ref HP application note 956-5).

Figure 2.

V± VOLTS	I_D µA	R_A Ω	R_B Ω	R_L Ω	T_r*(APPROX.) µs
5	40	0	120K	10K	.720
5	100	0	36K	1K	.270
15	40	1K	360K	10K	.720
15	100	1K	108K	1K	.270

*Risetime based on 1000 pf of internal capacitance. The risetime will be longer if external capacitance is added.

Video Load Selection Chart

The video load equals $R_B || R_L$ with R_A being the dropping resistor for supply voltages greater than +15 volts.

Figure 3

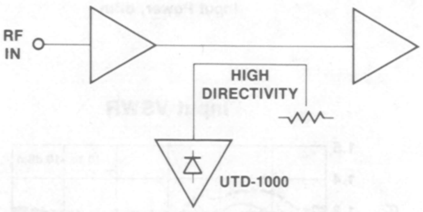
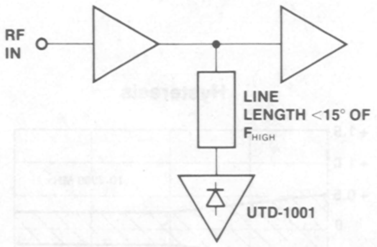


Figure 4



RF Considerations

In broadband level detection applications, the UTD-1000 (50-ohm input impedance) detector should be used with a high-directivity coupler to prevent frequency dependent output ripple. In narrowband applications (bandwidth <15%), the line may be directly sampled by the UTD-1001 detector. In both applications, the line length between the sampled point and the input to the UTD detector should be <15° at the highest sampled frequency to avoid VSWR degradation of the sampled line.

Figure 5.

+ SUPPLY VOLTAGE

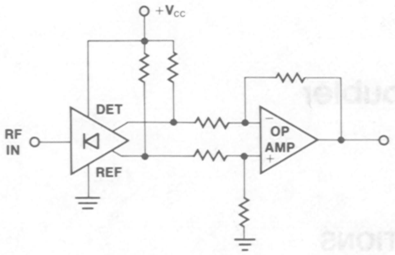
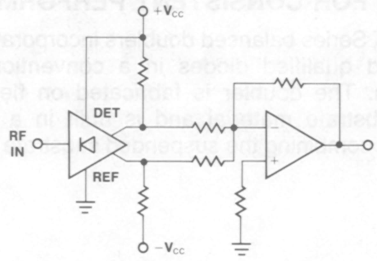

+Vcc
DET
REF
RF IN
OP AMP
−
+

Figure 6.

± SUPPLY VOLTAGE


+Vcc
DET
REF
RF IN
−
+
−Vcc

Biasing The Level Detector

The current through the detection diode is normally set in the 10 to 100 μA range. Its value will affect the dynamic video source impedance and the threshold level and should be selected to properly match the load impedance, bandwidth and threshold requirements. If only one (positive polarity) power supply line is available, the current through the reference diode may be positive, with the offset voltage compensation being provided by subtraction in a differentially-connected operational amplifier (Ref Figure 5). For better stability, it is recommended that a second (negative) power supply line be provided and that the current through the reference diode be negative with respect to ground. The offset voltage compensation may then be provided by an operational amplifier connected in a summing circuit (Ref Figure 6).

OTHER APPLICATIONS

Figure 7.

SYSTEM TEST POINT

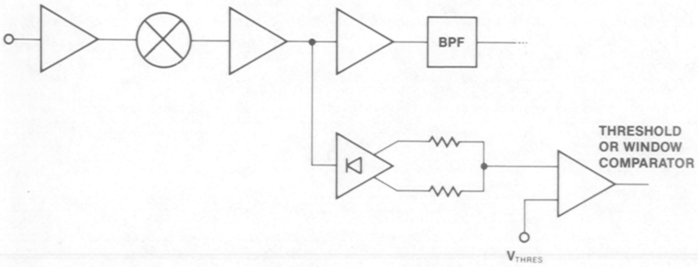

BPF
THRESHOLD OR WINDOW COMPARATOR
V_{THRES}

Figure 8.

AUTOMATIC LEVEL CONTROL

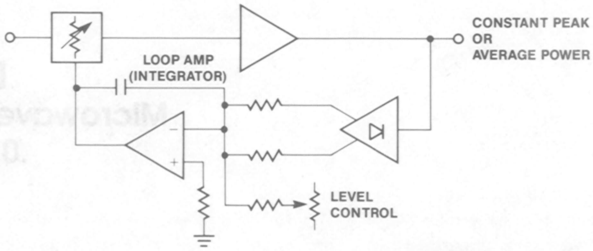

LOOP AMP (INTEGRATOR)
CONSTANT PEAK OR AVERAGE POWER
−
+
LEVEL CONTROL

Figure 9.

LINEAR MODULATOR

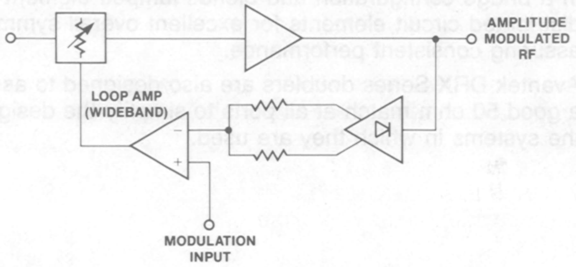
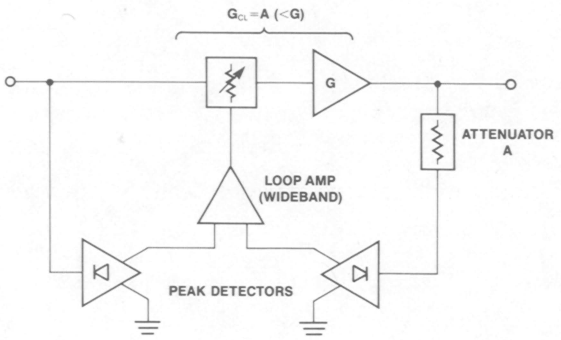

LOOP AMP (WIDEBAND)
AMPLITUDE MODULATED RF
−
+
MODULATION INPUT

Figure 10.

LINEARITY EXTENSION OR CONTROL


$G_{CL} = A\ (<G)$
G
ATTENUATOR A
LOOP AMP (WIDEBAND)
PEAK DETECTORS

The linear operating region of an amplifier can be extended by using two level detectors as shown above. This configuration forces the amplifier to follow normally compressed peaks in modulated RF signals.

DRX-2075
Microwave Frequency Doubler
.075 to 2 GHz

DESCRIPTION

The Avantek DRX-2075 is a balanced doubler offering excellent performance over a wide frequency range. It is packaged in the unique Avanpak miniature hermetic case for applications in microstripline or coaxial-interfaced systems.

This doubler uses precisely matched Schottky-barrier diodes in a bridge configuration and blends lumped element and distributed circuit elements for excellent overall symmetry assuring consistent performance.

Avantek DRX Series doublers are also designed to assure a good 50 ohm match at all ports to simplify the design of the systems in which they are used.

APPLICATIONS

The DRX-2075 is suitable for use in extending the frequency range of existing equipment, whether it is for test or to upgrade a system to operate at higher frequencies.

DESIGNED FOR CONSISTENT PERFORMANCE

Avantek DRX Series balanced doublers incorporate carefully matched and qualified diodes in a conventional bridge configuration. The doubler is fabricated on flexible, low-dielectric substrate material and is built in a symetrical configuration combining the suspended substrate technique.

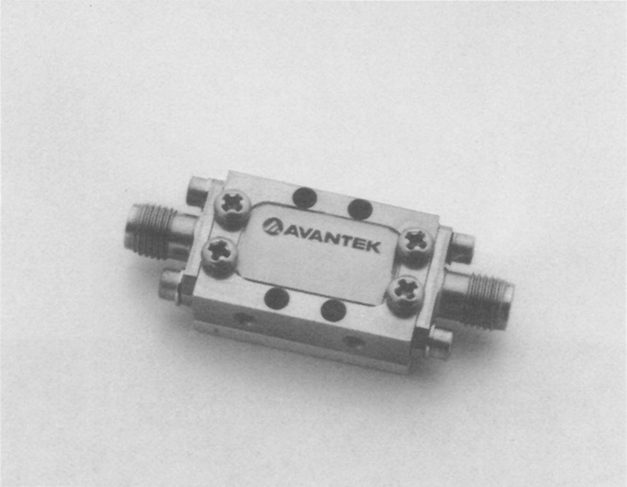
DRX-2075
(PRELIMINARY)

Avanpak
Doubler
.075-2 GHz

AVANTEK

FEATURES

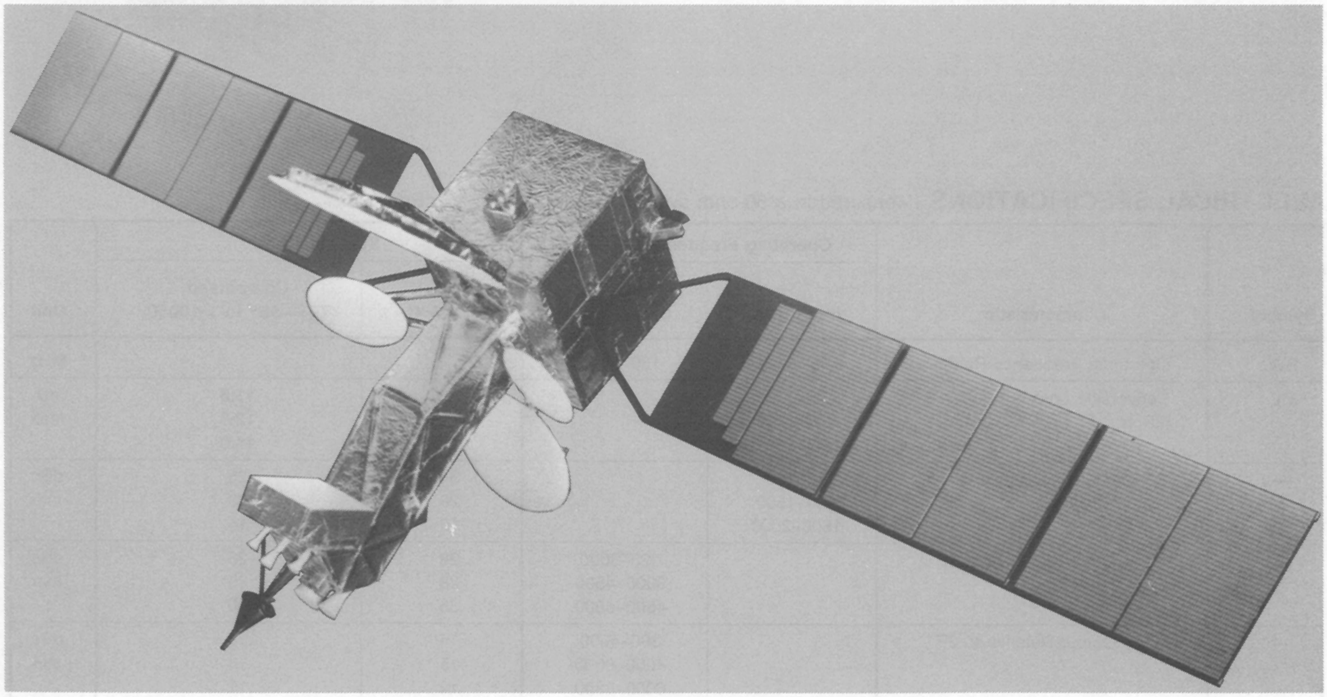
- **75 MHz to 2 GHz Input Bandwidth**
- **Low VSWR at Both Ports**
- **Low Conversion Loss**
- **+13 dBm Nominal Input Level**
- **Avanpak "Universal" Package**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system with input at +13 dBm)

		Operating Frequencies, MHz		Specifications		
Symbol	**Characteristic**	**Input Port**	**Output Port**	**Typical $T_C = 25°C$**	**Guaranteed $T_C = -55°$ to $+100°C$**	**Unit**
BW	Operating Frequency Range	75–2000	150–4000			MHz
CL	Conversion Loss (2F vs. 1F)	75–800 800–1500 1500–2000		10.0 11.0 12.5	11.5 12.5 14.0	dB max
—	1 F @ Output Relative to 2 F	75–800 800–1500 1500–2000		34 28 16	25 23 14	dBc min
—	3F @ Output Relative to 2F		225–3000 3000–4500 4500–6000	28 28 35	25 25 30	dBc min
—	4F @ Output Relative to 2F		300–4000 4000–6000 6000–8000	14 15 12	13 14 11	dBc min
—	Input VSWR (50 ohm)	75–1000 1000–1500 1500–2000		1.7 2.0 1.7	— —	max
—	Output VSWR (50 ohm)		150–1500 1500–3000 3000–4000	1.4 2.0 2.7	— — —	max

HIGH RELIABILITY



• Hi-Rel Screening

INTRODUCTION

First and Foremost, Built for Reliability

All Avantek® modular components are reliable by design. They are built with pre-qualified components using state-of-the-art process technology. Both the modules and the transistors and/or diodes used in them are supported by a comprehensive internal control and documentation program. Avantek has maintained lot processing traceability records for all fabrication processes beginning with the first UTO Series amplifier manufactured in June, 1970. Standard production procedures include the collection of lot performance data and subsequent user-experience monitoring. Inventory control of all components, including the wafer qualification of Avantek-produced RF transistor chips, assures lot-to-lot repeatability—and these hybrid products are backed by an extensive research and development effort to ensure the optimum quality, performance and reliability of all amplifier substrates and transistor die. This is all a part of in-production procedures for *standard* products that do not require additional high-reliability screening.

Avantek thin-film hybrid modules start out as select-grade ceramic wafers, chosen for both electrical uniformity and surface finish. Thin-film circuitry is deposited using advanced RF sputtering technology in a high-vacuum system, and multi-layer metallization is used throughout to combine excellent adherence to the ceramic substrate with optimal electrical performance. All circuit conductors—including RF inductors—are fabricated with a top layer of high-purity gold for excellent conductivity, corrosion resistance and to assure reliable bonds to interconnecting wires and to the eutectically-attached chip components. All resistors are thin-film tantalum nitride treated at a high temperature for stability and, in many amplifier modules, automatically laser-trimmed to within ±2% of the design value.

Circuit patterns are defined by high-resolution photolithography capable of producing consistent 1-mil line widths and 0.5-mil line spacing. This makes the circuitry repeatable and consistent, as well as eliminating the possibility of component failure due to insufficient conductor widths and excessive current density.

All interconnections between the chip components and the circuit, as well as between the circuit substrate and the RF and DC connection pins on the package, are made with thermosonic-bonded gold-alloy wires. Many of the modules are built on computer-controlled wire-bonding equipment which provides extremely consistent loops and bonds as well as making the production faster and more efficient—other units are manually wire bonded by highly skilled, well-trained operators.

Reliable by Design

From the beginning, Avantek chose thin-film construction for its microwave hybrid products because of the performance capability and the inherent reliability of this construction technique. With *over fifteen* years of thin-film hybrid experience Avantek has perfected the design and processing of these thin-film modules. Using the most reliable metal systems available and state-of-the-art processing equipment, Avantek produces all modules with long-term reliability in mind. All new designs are thoroughly tested and analyzed for reliability before being released to production.

Process Control

Since Avantek produces virtually all of its own transistor die, thin-film circuits and MOS capacitors, total control over the quality and reliability of each circuit component through all processing steps is assured. A modern system of material control, using computer tracking and bonded stores for key components, ensures rigid control through all operations. Traceability down to starting material is maintained for all components and, in the case of purchased items, to unique lot numbers. Each material lot is extensively qualified through actual production builds before being committed to volume production.

Avantek maintains a Program Office specifically to meet Hi Reliability requirements. This group of qualified professionals works directly with customers to make it easier to place orders for Hi-Rel-qualified components, and to provide the fastest possible order turn-around and shipment.

Avantek Transistors

MICamp® amplifiers incorporate Avantek-designed and produced transistors in all RF stages.

Avantek transistors have proven themselves in some of the most critical microwave applications and are extensively used in military communications, radar and ECM/EW/ESM systems as well as in equipment operating on board orbiting spacecraft. These transistors are both designed and tested to provide extremely uniform DC and RF performance characteristics.

All Avantek transistors are fabricated with a gold and refractory metal system with proven excellence in junction/contact performance, bond strength and freedom from current-induced metal migration under high current and temperature conditions. The present Avantek gold-based metal system used for all transistors, produces uniform metallization in the 1 μm width range and assures complete coverage of even abrupt contours on the surface of the chip. Even GaAs FET gate structures are gold metallized to eliminate the corrosion, intermetallic growth and burn-out problems associated with some metal systems.

Avantek uses a self-aligning nitride/oxide process to define the locations of active regions of bipolar transistors. This process eliminates the performance variations caused by minor misalignment of the photo masks used in processing and allows the production of precise 0.5 μm geometries. Ion implantation, diffused bias resistors and both arsenic and phosphorous doping of bipolar transistors emmiters provides transistors literally customized to provide performance and reliability in the modular amplifier application.

And, to assure the reliability of these transistors, all processing and manufacturing steps are monitored using rigid quality control.

MTBF

The stringent screening of Avantek modular components yields Mean Time Between Failure (MTBF) calculations of hundreds of thousands of hours under the most severe conditions. This reliability reflects the construction, screening, handling and rigid process controls employed by Avantek in the manufacture of all modular components.

The following Mean Time Between Failure (MTBF) analysis data for Avantek UTO Series amplifier modules is based on MIL-HDBK-217C with A_{UF} (Aircraft, Uninhabited Fighter) conditions and a temperature of 90°C.

UTO MTBF

Type	per 10^6 Hours	MTBF (Hours)
UTO-210R	1.19	833,706
UTO-211R	1.30	770,324
UTO-221R	.73	1,366,226
UTO-222R	.74	1,348,926
UTO-250R	1.51	661,159
UTO-501R	0.92	1,090,779
UTO-502R	0.86	1,163,841
UTO-503R	1.02	983,779
UTO-504R*	0.74	1,344,046
UTO-505R	1.07	930,705
UTO-509R	1.78	562,406
UTO-510R	1.21	828,656
UTO-511R	1.21	828,656
UTO-512R	1.07	931,338
UTO-513R	0.92	1,091,556
UTO-514R	1.05	949,186
UTO-515R	0.94	1,064,661
UTO-516R	1.05	952,502
UTO-517R	1.01	993,691
UTO-518R	1.98	505,356
UTO-519R	1.55	646,545
UTO-521R	0.81	1,236,047
UTO-523R	0.84	1,187,895
UTO-524R	1.76	567,008
UTO-533R	1.01	991,658
UTO-543R	0.94	1,065,331
UTO-544R	1.16	862,436
UTO-545R	1.05	949,186
UTO-546R	1.24	806,452
UTO-561R*	1.17	857,783
UTO-1001R	1.04	962,932
UTO-1002R	1.10	910,448
UTO-1004R	1.26	793,867
UTO-1005R	2.01	498,452
UTO-1006R	1.73	579,341
UTO-1011R	0.90	1,112,818
UTO-1012R	1.05	953,751
UTO-1013R	1.23	813,076
UTO-1021R	2.11	474,271
UTO-1033R	1.18	847,163
UTO-1043R	1.13	886,475
UTO-1044R	1.17	851,323
UTO-1501R	0.95	1,052,880
UTO-1502R	1.08	929,937
UTO-1511R	1.14	878,807
UTO-1522R	1.61	621,389
UTO-1524R	1.61	620,497
UTO-2012R	1.16	862,069
UTO-2021R	1.38	722,789
UTO-2022R	1.30	768,129
UTO-2023R	1.16	857.646

*Temperature is 71°C

The following Mean Time Between Failure (MTBF) analysis data for Avantek GPD Series amplifier modules is based on MIL-HDBK-217C with A_{UF} (Aircraft, Uninhabited Fighter) conditions and a temperature of 90°C operating temperature (except where noted).

GPD MTBF

Type	per 10^6 Hours	MTBF (Hours)
GPD-201R	0.59	1,678,671
GPD-202R	0.62	1,621,478
GPD-251R	0.59	1,678,323
GPD-252R	0.50	2,000,740
GPD-401R	0.49	2,045,316
GPD-411R	0.62	1,608,303
GPD-402R	0.43	2,325,901
GPD-403R*	0.33	3,058,127
GPD-404R	0.41	2,435,672
GPD-405R	0.62	1,607,022
GPD-1001R	0.61	1.639,228
GPD-1002R	0.61	1,639,228
GPD-1003R	0.61	1,636,498
GPD-461R	0.42	2,388,527
GPD-462R	0.38	2,640,329
GPD-463R*	0.28	3,602,215
GPD-464R	0.40	2,512,908
GPD-1061R	0.53	1,910,397
GPD-1062R	0.53	1,882,476
GPD-1063R	0.48	2,101,101

*@ 71°C operating

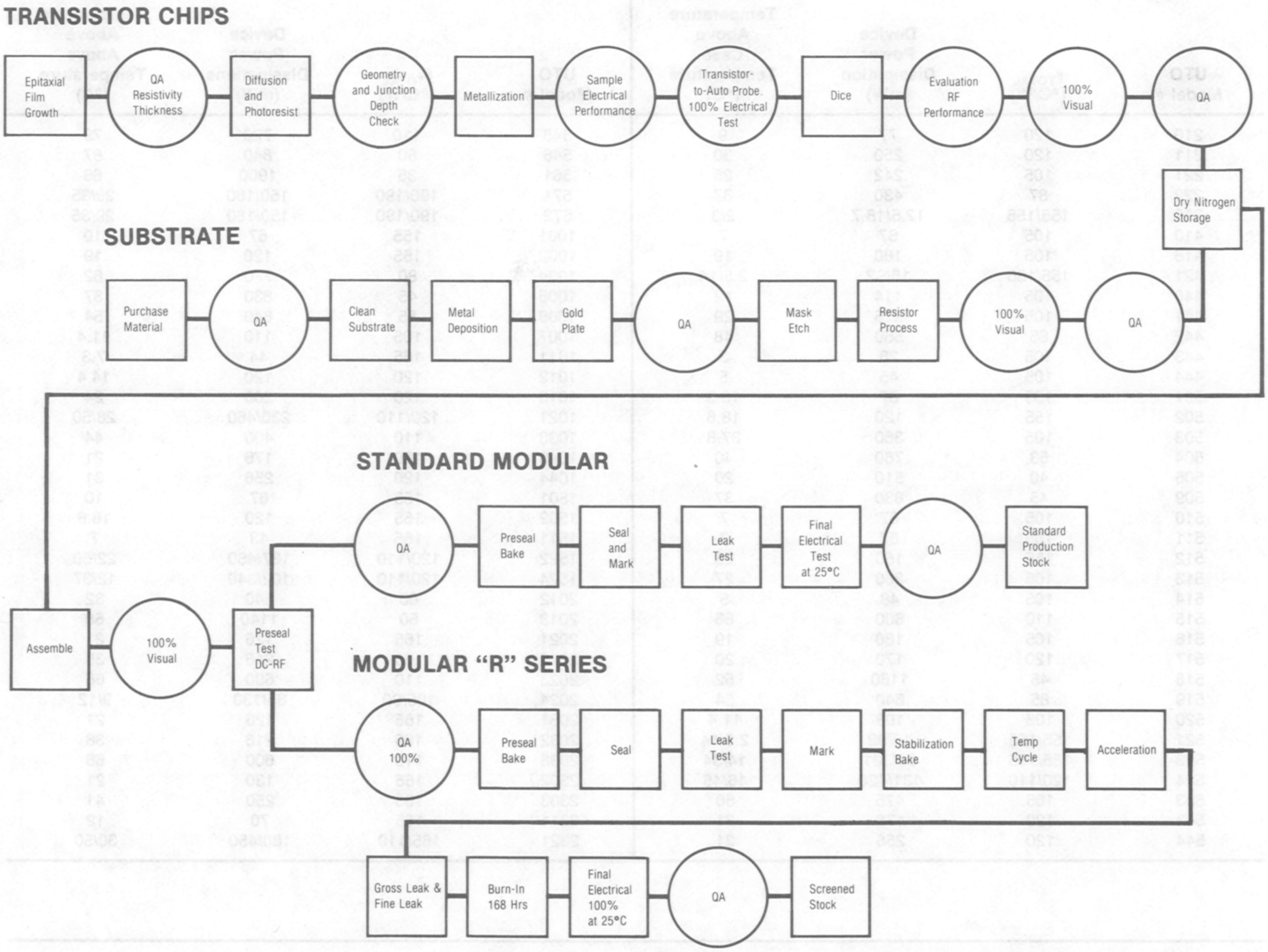
THERMAL CHARACTERISTICS OF UTO CASCADABLE AMPLIFIERS

UTO Model #	θ_{TOTAL} (°C/W)	Device Power Dissipation (mW)	Junction Temperature Above Case Temperature (°C)	UTO Model #	θ_{TOTAL} (°C/W)	Device Power Dissipations (mW)	Junction Temperature Above Above Temperature (°C)
210	120	77	9	545	110	720	79
211	120	250	30	546	80	840	67
221	105	242	25	561	35	1900	66
222	87	430	37	571	190/190	150/180	29/35
250	155/155	12.5/18.7	2/3	572	190/190	150/180	29/35
410	105	67	7	1001	155	67	10
416	105	180	19	1002	155	120	19
421	155/155	16/92	2.5/14	1004	80	770	62
440	105	114	12	1005	45	830	37
441	105	275	29	1008	85	640	54
442	85	560	48	1007	105	110	11.4
443	105	28	3	1011	165	44	7.3
444	105	45	5	1012	120	120	14.4
501	155	67	10.3	1013	120	200	24
502	155	120	18.6	1021	120/110	230/460	28/50
503	105	360	37.8	1033	110	400	44
504	53	760	40	1043	120	176	21
505	40	510	20	1044	120	256	31
509	45	830	37	1501	155	67	10
510	105	67	7	1502	155	120	18.6
511	105	67	7	1511	165	43	7
512	155	150	23	1522	120/110	187/460	22/50
513	105	260	27	1524	120/110	102/340	12/37
514	105	48	5	2012	60	540	32
515	110	600	66	2013	60	1140	68
516	105	180	19	2021	165	126	21
517	120	170	20	2022	165	216	36
518	45	1160	52	2023	110	600	66
519	85	640	54	2024	105/90	85/130	9/12
520	105	108	11.4	2031	165	126	21
521	155/155	16/92	2.5/14	2032	165	216	36
523	155/105	90/321	14/34	2033	110	600	66
524	120/110	131/420	16/46	2302	165	130	21
533	105	475	50	2303	165	250	41
543	120	176	21	2311	165	70	12
544	120	256	31	2321	165/110	180/450	30/50

THERMAL CHARACTERISTICS OF GPD CASCADABLE AMPLIFIERS

GPD Model #	θ_{TOTAL} (°C/W)	Device Power Dissipation (mW)	Junction Temperature Above Case Temperature (°C)	GPD Model #	θ_{TOTAL} (°C/W)	Device Power Dissipations (mW)	Junction Temperature Above Above Temperature (°C)
201	160	31.5	5	404/464	100	330	33
202	160	117	18.8	405	80	750	60
251	160	38.4	6	411	160	23.6	3.8
252	150	8	1.2	1001/1061	160	81.6	13
401/461	150	14	2	1002/1062	160	81.6	13
402/462	150	82	12.3	1003/1063	105	225	23.7
403/463	100	275	27.5				

"R" SERIES MICamp® THIN-FILM AMPLIFIER FLOW CHART


TRANSISTOR CHIPS
Epitaxial Film Growth
QA Resistivity Thickness
Diffusion and Photoresist
Geometry and Junction Depth Check
Metallization
Sample Electrical Performance
Transistor-to-Auto Probe. 100% Electrical Test
Dice
Evaluation RF Performance
100% Visual
QA
Dry Nitrogen Storage
SUBSTRATE
Purchase Material
QA
Clean Substrate
Metal Deposition
Gold Plate
QA
Mask Etch
Resistor Process
100% Visual
QA
Assemble
100% Visual
Preseal Test DC-RF
STANDARD MODULAR
QA
Preseal Bake
Seal and Mark
Leak Test
Final Electrical Test at 25°C
QA
Standard Production Stock
MODULAR "R" SERIES
QA 100%
Preseal Bake
Seal
Leak Test
Mark
Stabilization Bake
Temp Cycle
Acceleration
Gross Leak & Fine Leak
Burn-In 168 Hrs
Final Electrical 100% at 25°C
QA
Screened Stock

"R" Series

Avantek "R" Series Screening was developed over 15 years ago to satisfy a market for screened thin film amplifiers. The screening meets the intent of MIL-STD-883, Method 5004, Level B. The "R" Series processing has proven to be an effective screen for increasing reliability and reducing infant mortality.

We now offer this cost and time effective approach on the following product lines. It is specified by adding an "R" suffix to the unscreened standard Avantek model number (example: UTO-502R). Typical delivery to be added to the standard parts is 3 weeks.

Modular TO-Products "R" Series (MIL-STD-883)

TEST	METHOD	CONDITION
Quality Visual	(Note 1)	AWS-014355-800
Pre-Seal Bake		$T_A = 150°C$, 2 Hrs.
Stabilization Bake	1008	B; $T_A = 125°C$, 24 Hrs. Min.
Temperature Cycle	1010	B; 10 cycles, –55 to +125°C
Centrifuge	2001	D; Y_1, 20 KG's
Fine Leak	1014	A; 5×10^{-8} ATM cc/sec Max.
Gross Leak	1014	C
Burn-In	1015 (Note 2)	B; 168 Hrs., $T_C = +71°$ to +125°C
Final Electrical	(Note 3)	25°C Tests
External Visual	2009	

Note 1: Internal visual written to meet the Intent of Method 2017 MIL-STD-883 for microwave devices. For reference see Avantek procedure AWS-014355-800.

Note 2: See specific specification (catalog) for burn-in temperature and bias conditions.

Note 3: See specific specification (catalog) for test conditions.

PlanarPak "R" Series (MIL-STD-883)

TEST	METHOD	CONDITION
Quality Visual	(Note 1)	AWS-014355-800
Pre-Seal Bake		$T_A = 125°C$, 2 Hrs.
Stabilization Bake	1008	B; $T_A = 125°C$, 24 Hrs. Min.
Temperature Cycle	1010	B; 10 cycles, –55 to +125°C
Centrifuge	2001	D; Y_1, 20 KG's
Fine Leak	1014	A; 5×10^{-8} ATM cc/sec Max.
Gross Leak	1014	C
Burn-In	1015 (Note 2)	B; 168 Hrs., $T_C = +71°$ to +125°C
Final Electrical	(Note 3)	25°C Tests
External Visual	2009	

Note 1: Internal visual written to meet the Intent of Method 2017 MIL-STD-883 for microwave devices. For reference see Avantek procedure AWS-014355-800.

Note 2: See specific specification (catalog) for burn-in temperature and bias conditions.

Note 3: See specific specification (catalog) for test conditions.

AvanPak Act Amplifiers "R" Series (MIL-STD-883)

TEST	METHOD	CONDITION
Quality Visual	(Note 1)	AWS-014355-800
Pre-Seal Bake		$T_A = 125°C$, 2 Hrs.
Stabilization Bake	1008	B; $T_A = 125°C$, 24 Hrs. Min.
Temperature Cycle	1010	B; 10 cycles, –55 to +125°C
Centrifuge	2001	A; Y_1, 5 KG's
Fine Leak	1014	A; 2×10^{-7} ATM cc/sec Max.
Gross Leak	1014	C
Burn-In	1015 (Note 2)	B; 168 Hrs., $T_C = +71°$ to +125°C
Final Electrical	(Note 3)	25°C Tests
External Visual	2009	

Note 1: Internal visual written to meet the Intent of Method 2017 MIL-STD-883 for microwave devices. For reference see Avantek procedure AWS-014355-800.

Note 2: See specific specification (catalog) for burn-in bias.

Note 3: See specific specification (catalog) for test conditions.

“R” Series (continued)

Mixer “R” Series (MIL-STD-883)

TEST	METHOD	CONDITION
Quality Visual	(Note 1)	AWS-014355-800
Pre-Seal Bake		$T_A = 125°C$, 2 Hrs.
Stabilization Bake	1008	B; $T_A = 125°C$, 24 Hrs. Min.
Temperature Cycle	1010	B; 10 cycles, –55 to +125°C
Centrifuge	2001	B; Y_1, 10 KG's
Fine Leak	1014 (Note 2)	A; 2×10^{-7} ATM cc/sec Max.
Gross Leak	1014	C
Final Electrical	(Note 3)	25°C Tests
External Visual	2009	

Note 1: Internal visual written to meet the Intent of Method 2017 MIL-STD-883 for microwave devices. For reference see Avantek procedure AWS-014355-800.

Note 2: UMX-TO-8 Leak Rate 5×10^{-8}.

Note 3: See specific specification (catalog) for test conditions.

Control Devices “R” Series (MIL-STD-883)

TEST	METHOD	CONDITION
Quality Visual	(Note 1)	AWS-014355-800
Pre-Seal Bake		$T_A = 125°C$, 2 Hrs.
Stabilization Bake	1008	B; $T_A = 125°C$, 24 Hrs. Min.
Temperature Cycle	1010	B; 10 cycles, –55 to +125°C
Centrifuge	2001	B; Y_1, 10 KG's
Fine Leak	1014 (Note 2)	A; 5×10^{-8} ATM cc/sec Max.
Gross Leak	1014	C
Burn-In	1015 (Note 3)	D; 168 Hrs., $T_C = +125°C$
Final Electrical	(Note 4)	25°C Tests
External Visual	2009	

Note 1: Internal visual written to meet the Intent of Method 2017 MIL-STD-883 for microwave devices. For reference see Avantek procedure AWS-014355-800.

Note 2: Leak Rate is $2 \times^{-7}$ for multithrow devices (AHT, AHQ and AHF).

Note 3: See specific specification (catalog) for burn-in bias—delete burn-in for Limiters.

Note 4: See specific specification (catalog) for test conditions.

Dedicated Hi-Rel Line for Space Applications

A captive Space Rel line has been established for those applications involving complex software/screening requirements providing documented evidence of step-by-step compliance.

Space Hi-Rel Processing Will Include:

- Quality Certified
  - Operators
  - Equipment
- Bond Strength/Die Shear Monitoring
- Dedicated Stations
  - Laminated Flow environment
  - ESD protection at all levels
- Material
  - Element Screening
  - Wafer Qualification
- Documentation
  - Traceability to component level
  - Software — Acceptance Test Procedure
    — Qualification Procedures
    — Data Book Reporting
- Configuration Management
  - Computerized system for configuration control

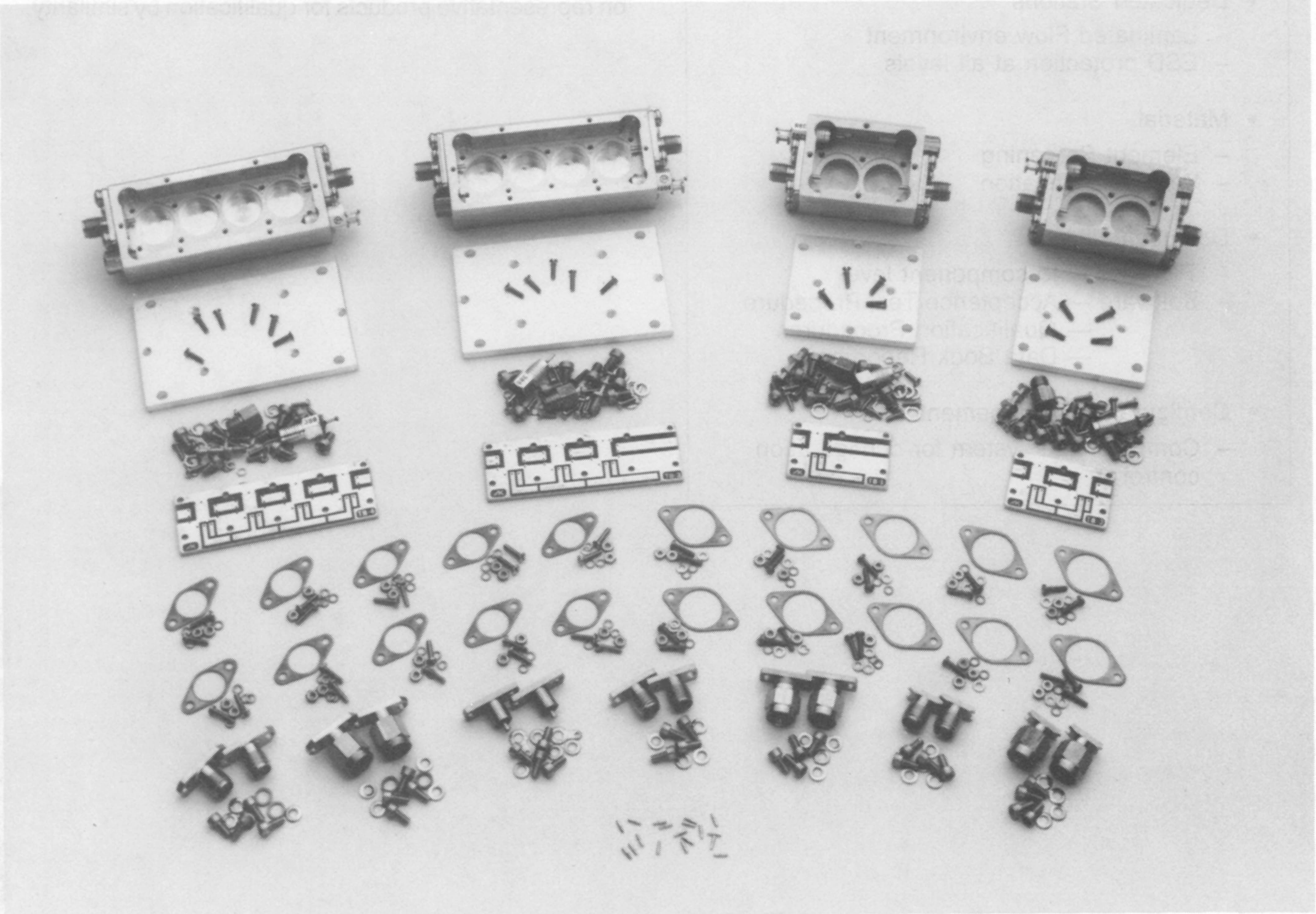
Program Management

In applications involving more difficult software/system requirements and critical schedules, a permanent dedicated Hi-Rel Program Office is available to establish and carry out all program requirements.

Working closely with manufacturing, engineering and the Quality Department, the Program Office plans, directs and monitors the product flow for products which require special handling. Each order is reviewed upon receipt and individually documented to insure that all processing is done to the customer's requirements.

In addition, the Program Office is responsible for periodically conducting tests on key products to maintain up-to-date files on quality and reliability chacacteristics. In many cases generic data is available on representative products for qualification by similarity.

HARDWARE



• Hardware

INTRODUCTION

To aid the user in achieving optimum performance and to provide flexibility in the use of Modular Components, Avantek offers a wide range of hardware accessories. The following pages provide dimensional and ordering information for all hardware and accessories available from Avantek. Note: All of the hardware described below is available from Avantek only as indicated; the individual kit components, such as screws, washers or mounting rings will not be available separately from Avantek. All of the following hardware are stocked by Avantek authorized distributors and the user should contact the nearest Avantek authorized distributor for these items.

GPD AND UTO MOUNTING KITS.

TO-12 Accessory Pack

Order Kit No. 330-006756-001

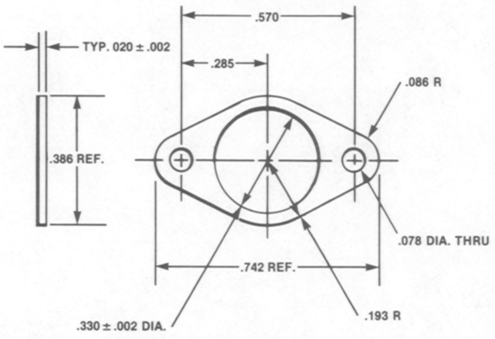
Consisting Of:
- 2 ea 0-80 × ¼ Pan Head Slotted
- 2 ea #0 Washer, Flat Reduced OD
- 2 ea #0 Washer, Split Lock
- 2 ea #0 Nut, S.P.
- 1 ea GPD Mounting Ring

TO-8 Accessory Pak

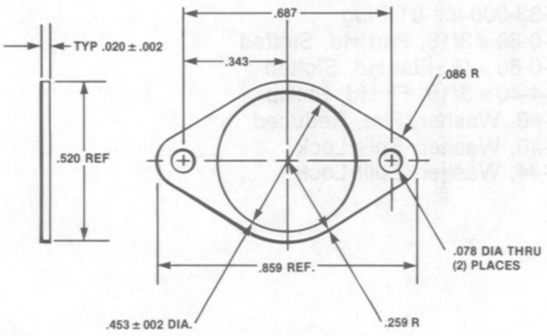
Order Kit No. 330-001951-001

Consisting Of:
- 2 ea 0-80 × ¼ Pan Head Slotted
- 2 ea #0 Washer, Flat Reduced OD
- 2 ea #0 Washer, Split Lock
- 2 ea #0 Nut, S.P.
- 1 ea UTO Mounting Ring

TO-12, MOUNTING RING

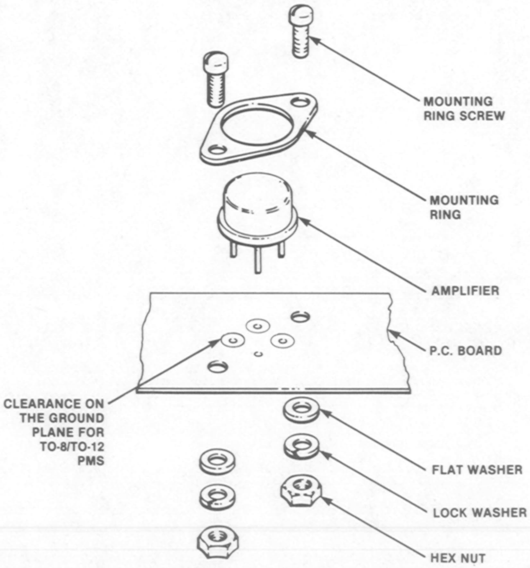

.570
TYP. .020 ± .002
.285
.086 R
.386 REF.
.078 DIA. THRU
.742 REF.
.330 ± .002 DIA.
.193 R

TO-8, MOUNTING RING


.687
TYP .020 ± .002
.343
.086 R
.520 REF
.078 DIA THRU
(2) PLACES
.859 REF.
.453 ± 002 DIA.
.259 R

RING MOUNTING

DIMENSIONS ARE IN INCHES


MOUNTING RING SCREW
MOUNTING RING
AMPLIFIER
P.C. BOARD
CLEARANCE ON THE GROUND PLANE FOR TO-8/TO-12 PMS
FLAT WASHER
LOCK WASHER
HEX NUT

CASCADE KITS AND HARDWARE

CIRCUIT BOARDS (Hardware not included with Circuit Boards)

Part Number	Description
GP-2	Connects two GPD (TO-12) components in TC-2 case.
GP-4	Connects three or four GPD (TO-12) components in TC-4 case.
TB-1A	Connects one TO-8 component in TC-1 case.
TB-1	Connects one TO-8 component in TC-2 case.
TB-2	Connects two TO-8 components in TC-2 case.
TB-3	Connects three TO-8 components in TC-4 case.
TB-4	Connects four TO-8 components in TC-4 case.

CASES (Includes case, lid, mounting hardware kit no. 330-001859-001 and connectors)

TC-1	Case for single TO-8 or TO-12 component (SMA connectors only).
TC-2X	Case for two TO-8 or TO-12 components.
TC-4X	Case for three or four TO-8 or TO-12 components.

NOTES: X = Connector options
N = N Type
M = SMA (OSM)
T = TNC
B = BNC

Spare Mounting Hardware Kit No. 330-01859-001 consists of:

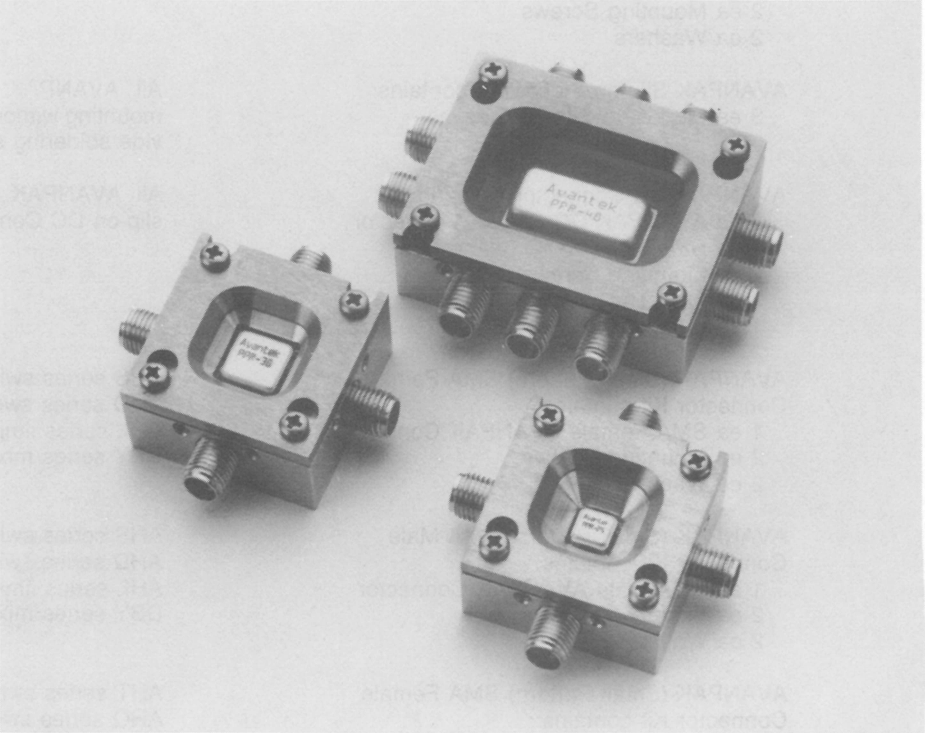
1–SMFB-A2 Filter DC
1–2051-2 Ground Terminal
1–33-000401-01 Plug
10–0-80 × 3/16, Pan Hd, Slotted
6–0-80 × ¼, Flat Hd, Slotted
8–4-40 × 3/16, Fil Hd, Phillip
10–#0, Washer, Flat, Reduced
10–#0, Washer, Split Lock
8–#4, Washer, Split Lock

AVANPAK HARDWARE

Model Number	Description	Use With
SK-001	AVANPAK SMA Female Connector Kit contains: 1 ea SMA Female AVANPAK Connector 1 ea RFI gasket 2 ea Mounting Screws 2 ea Washers	ACT series cascades DBX series mixers
SK-002	AVANPAK SMA Male Connector Kit contains: 1 ea SMA Male AVANPAK Connector 1 ea RFI Gasket 2 ea Mounting Screws 2 ea Washers	ACT series cascades DBX series mixers
SK-003	AVANPAK Slip-on Sleeve Kit contains: 3 ea Microstrip Slip-on Sleeves	All AVANPAK components when mounting without connectors to provide soldering strain relief.
SK-004	AVANPAK DC Connector Kit contains: 1 ea AVANPAK DC Slip-on Connector 1 ea RFI Gasket 2 ea Mounting Screws 2 ea Mounting Washers 1 ea Solder Lug	All AVANPAK components where slip-on DC Connection is desired.
SK-005	AVANPAK (Small Pattern) SMA Female Connector Kit contains: 1 ea SMA Female AVANPAK Connector 2 ea Mounting Screws 2 ea Washers	AHS series switches AHD series switches AHL series limiters DBY series mixers
SK-006	AVANPAK (Small Pattern) SMA Male Connector Kit contains: 1 ea SMA Male AVANPAK Connector 2 ea Mounting Screws 2 ea Washers	AHS series switches AHD series switches AHL series limiters DBY series mixers
SK-009	AVANPAK (Small Pattern) SMA Female Connector Kit contains: 1 ea SMA Female AVANPAK Connector 2 ea Mounting Screws 2 ea Washers	AHT series switches AHQ series switches AHF series switches
SK-010	AVANPAK (Small Pattern) SMA Male Connector Kit contains: 1 ea SMA Male AVANPAK Connector 2 ea Mounting Screws 2 ea Washers	AHT series switches AHQ series switches AHF series switches

TEST FIXTURES

Part Number	Description
PPTF-25	RF Test Fixture for .25″ Planar Pak products.
PPTF-38	RF Test Fixture for .375″ Planar Pak products.
PPTF-48	RF Test Fixture for .4 x .8″ Planar Pak products.


Avantek
PPP-48
Avantek
PPP-38
Avantek
PPP-25

NOTES:

CASE DRAWINGS

AVANTEK
AVANTEK
AVANTEK
AVANTEK
AVANTEK
AVANTEK
AVANTEK
AVANTEK
AVANTEK
AVANTEK
AVANTEK

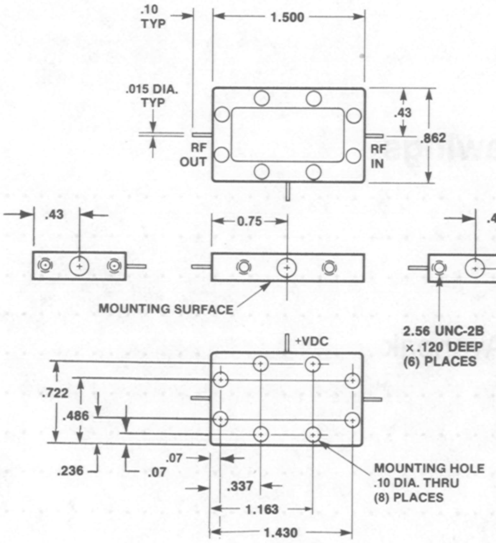
Case Drawings

AS 2 384
DBX 385
DBY 386
Dip 387
Limiter Avanpak 388
MA-1 389
MA-2 389
MA-3 389
PP-25 390
PP-38 391
PP-48 392
SA-1 393
Slip-On Sleeves 394
SPST 395
SPDT 396
SPMT 397
TC 1 398
TC 2 399
TC 4 399
TO-3 400
TO-8F 401
TO-8M 401
TO-8T 402
TO-8U 402
TO-12 403

• AS 2 Case Drawings

AVANPAK PIN PACKAGE

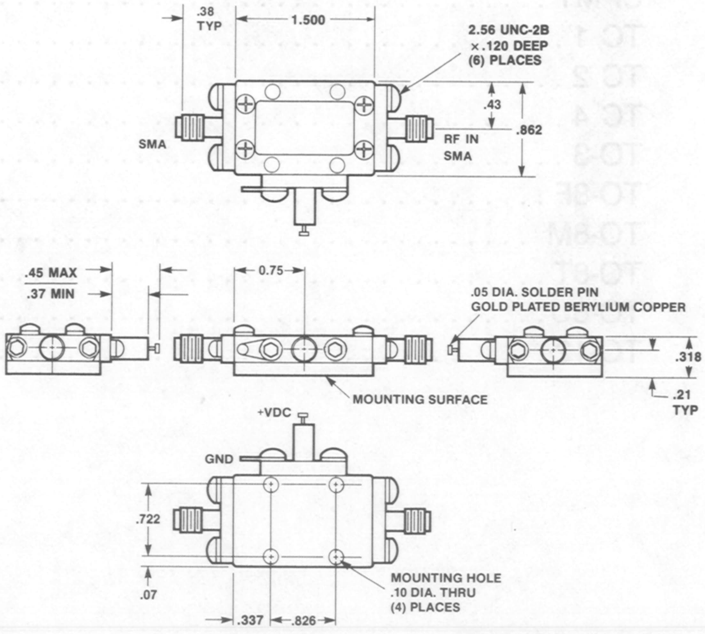
TOLERANCES: XX ± .01
XXX ± .005
MATERIAL: 303 STAINLESS STEEL



.10 TYP
1.500
.015 DIA. TYP
.43
.862
RF OUT
RF IN
.43
0.75
.43
.224
MOUNTING SURFACE
.112 ± .007 TYP
2.56 UNC-2B × .120 DEEP (6) PLACES
+VDC
.722
.486
.236
.07
.07
.337
1.163
1.430
MOUNTING HOLE .10 DIA. THRU (8) PLACES

AVANPAK SMA PACKAGE

TOLERANCES: .XX ± .01
.XXX ± .005
MATERIAL: BODY & RF CONNECTORS — 303 STAINLESS STEEL
MOUNTING SPACER — ALUMINUM ALLOY
FILTER BODY — NICKEL PLATED BRASS



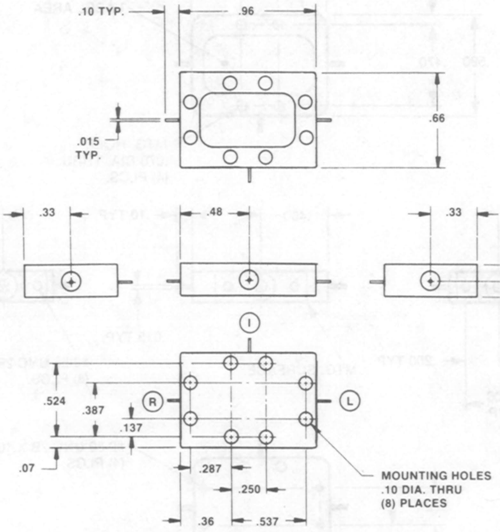
.38 TYP
1.500
2.56 UNC-2B × .120 DEEP (6) PLACES
.43
.862
SMA
RF IN SMA
.45 MAX
.37 MIN
0.75
.05 DIA. SOLDER PIN GOLD PLATED BERYLIUM COPPER
.318
.21 TYP
MOUNTING SURFACE
+VDC
GND
.722
.07
.337
.826
MOUNTING HOLE .10 DIA. THRU (4) PLACES

Note: Use Connector Kits SK-001 and SK-002.

• DBX Case Drawings

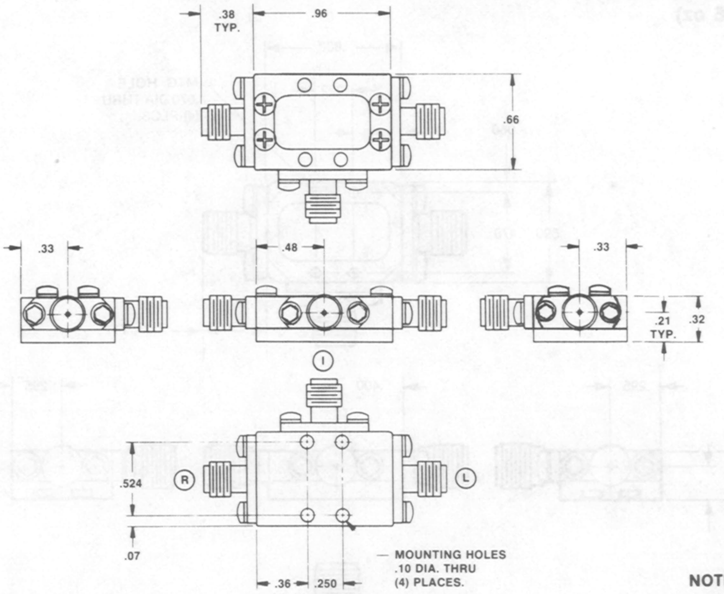
DBX CASE (WITHOUT CONNECTORS)

Approx. Weight 13 grams (.5 oz)


.10 TYP.
.96
.015
TYP.
.66
.33
.48
.33
.22
.11 TYP.
I
R
L
.524
.387
.137
.07
.287
.250
.36
.537
MOUNTING HOLES
.10 DIA. THRU
(8) PLACES

DBX CASE (WITH CONNECTORS AND BOTTOM SPACER PLATE)

Approx. Weight 22 grams (.8 oz)

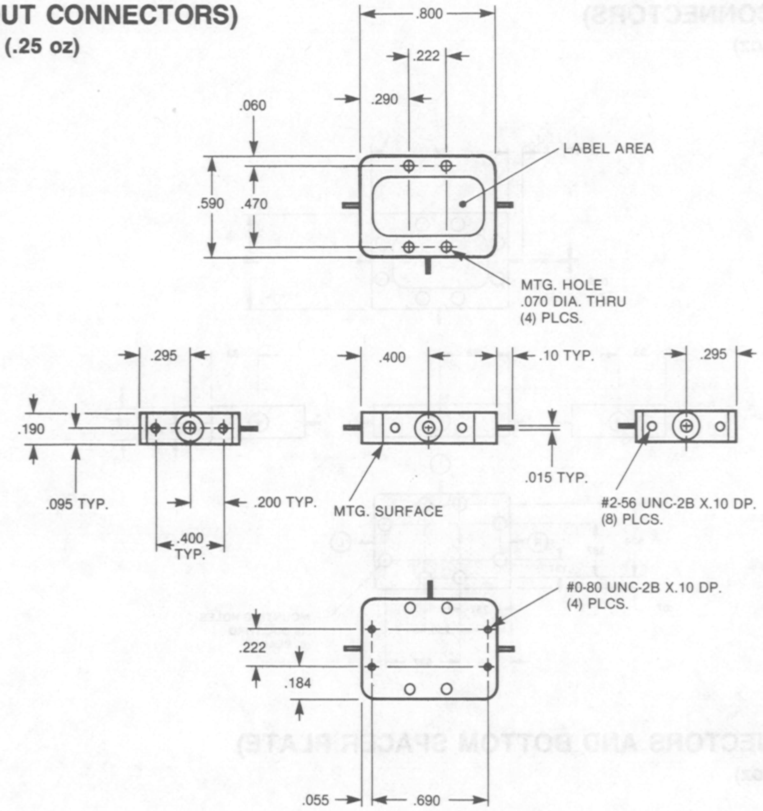

.38
TYP.
.96
.66
.33
.48
.33
.21
TYP.
.32
I
R
L
.524
.07
.36
.250
MOUNTING HOLES
.10 DIA. THRU
(4) PLACES.

NOTE:
1. **ALL DIMENSIONS IN INCHES**
2. **TOLERANCES: .XX ±.02**
   .XXX ±.010
3. **CONNECTORS, TYPE SMA FEMALE**
   (SMA MALE OR SEMI RIGID OPTIONAL)

• DBY Case Drawings

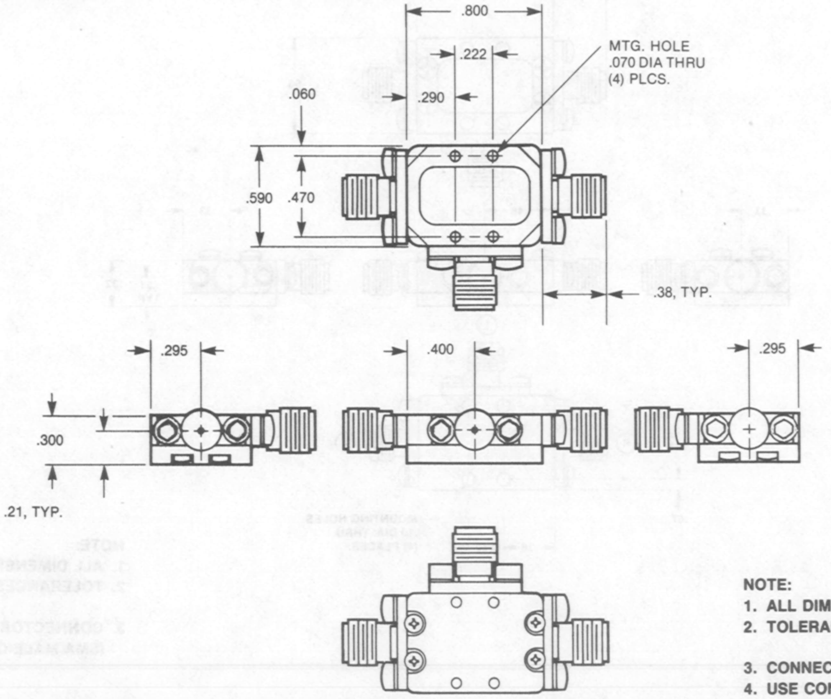
DBY CASE (WITHOUT CONNECTORS)

Appox. Weight 7 grams (.25 oz)


.800
.222
.290
.060
LABEL AREA
.590
.470
MTG. HOLE
.070 DIA. THRU
(4) PLCS.
.295
.400
.10 TYP.
.295
.190
.095 TYP.
.200 TYP.
MTG. SURFACE
.015 TYP.
#2-56 UNC-2B X.10 DP.
(8) PLCS.
.400
TYP.
#0-80 UNC-2B X.10 DP.
(4) PLCS.
.222
.184
.055
.690

DBY CASE (WITH CONNECTORS AND BOTTOM SPACER PLATE)

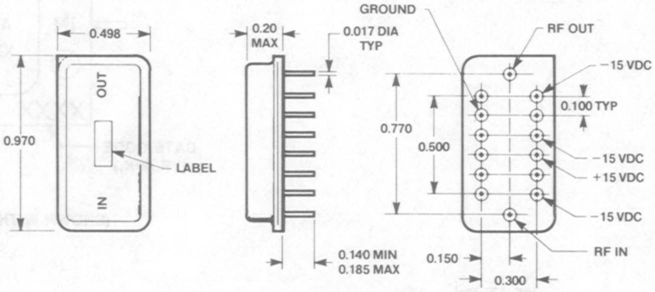
Approx. Weight 16 grams (.6 oz)


.800
MTG. HOLE
.070 DIA THRU
(4) PLCS.
.222
.060
.290
.590
.470
.38, TYP.
.295
.400
.295
.300
.21, TYP.

NOTE:
1. ALL DIMENSIONS IN INCHES
2. TOLERANCES: .XX ± .02
   .XXX ± .010
3. CONNECTORS, TYPE SMA FEMALE
4. USE CONNECTOR KITS SK-005 AND SK-006

• DIP Case Drawings

DIP

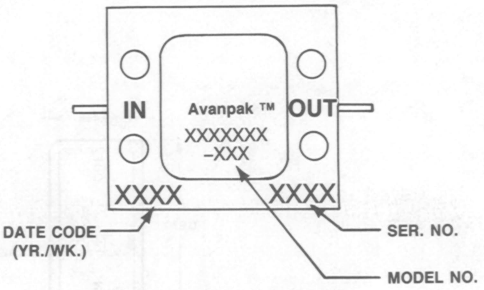

0.498
OUT
0.970
LABEL
IN
0.20 MAX
0.017 DIA TYP
0.140 MIN
0.185 MAX
GROUND
RF OUT
−15 VDC
0.100 TYP
0.770
0.500
−15 VDC
+15 VDC
−15 VDC
RF IN
0.150
0.300

Typical Weight 6 grams (.2 oz)

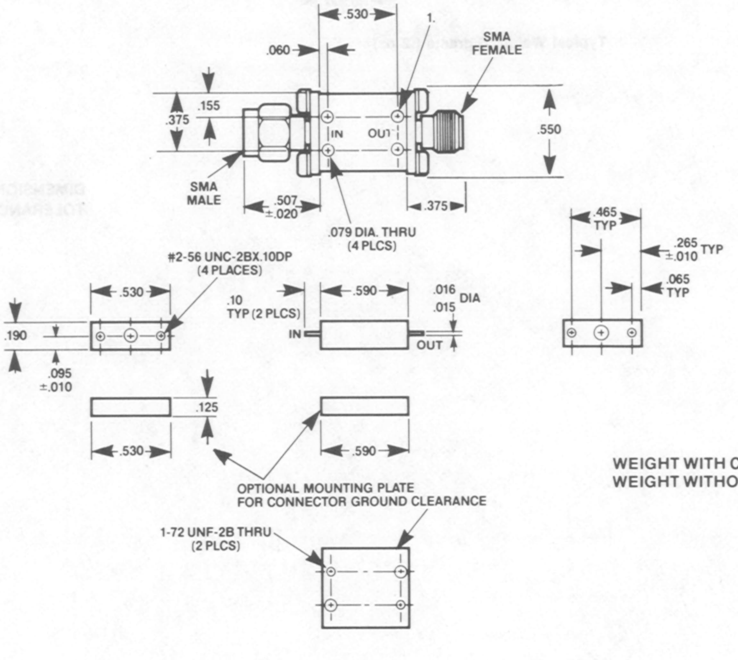
DIMENSIONS IN INCHES
TOLERANCES: XX ± .02
XXX ± .010.

• Limiter Avanpak Case Drawings

LIMITER AVANPAK CASE


IN
Avanpak ™
XXXXXXX
-XXX
OUT
XXXX
XXXX
DATE CODE
(YR./WK.)
SER. NO.
MODEL NO.

(SHOWN WITHOUT CONNECTORS)


.530
1.
.060
SMA
FEMALE
.155
.375
IN
OUT
.550
SMA
MALE
.507
±.020
.375
.079 DIA. THRU
(4 PLCS)
.465
TYP
.265
±.010 TYP
.065
TYP
#2-56 UNC-2BX.10DP
(4 PLACES)
.530
.10
TYP (2 PLCS)
.590
.016
.015 DIA
.190
IN
OUT
.095
±.010
.125
.530
.590
OPTIONAL MOUNTING PLATE
FOR CONNECTOR GROUND CLEARANCE
1-72 UNF-2B THRU
(2 PLCS)

CONNECTOR OPTION TABLE		
DASH NO.	INPUT	OUTPUT
-001	FEM	FEM
-002	NONE	NONE
-003	MALE	MALE
-004	MALE	FEM
-005	FEM	MALE

WEIGHT WITH CONNECTORS AND SPACER = 10.5 GRAMS
WEIGHT WITHOUT CONNECTORS AND SPACER = 5.0 GRAMS

NOTES (UNLESS OTHERWISE SPECIFIED)
DIMENSIONS IN INCHES
TOLERANCES: XX ± .02
XXX ± .010

USE CONNECTOR KITS SK-005 AND SK-006

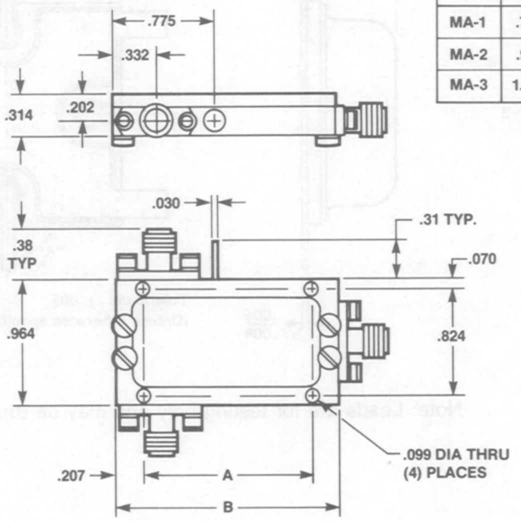
NOTES: (UNLESS OTHERWISE SPECIFIED)

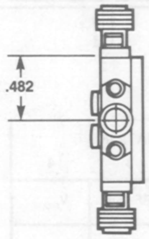
1. CLEARANCE HOLE FOR #1-72 UNC-2A × 5/16″ FOR MOUNTING OPTIONAL SPACER PLATE.
2. SMA CONNECTORS OPTIONAL SHOWN FOR DIMENSIONAL PURPOSES.

• MA-1, MA-2, MA-3 Case Drawings

MA-1
MA-2
MA-3

CASE TYPE	DIM. A	DIM. B	TYPICAL WEIGHT
MA-1	.763	1.040	40 grams
MA-2	.956	1.370	50 grams
MA-3	1.286	1.700	60 grams


.775
.332
.314
.202
.030
.31 TYP.
.070
.38 TYP
.964
.824
.099 DIA THRU (4) PLACES
.207
A
B

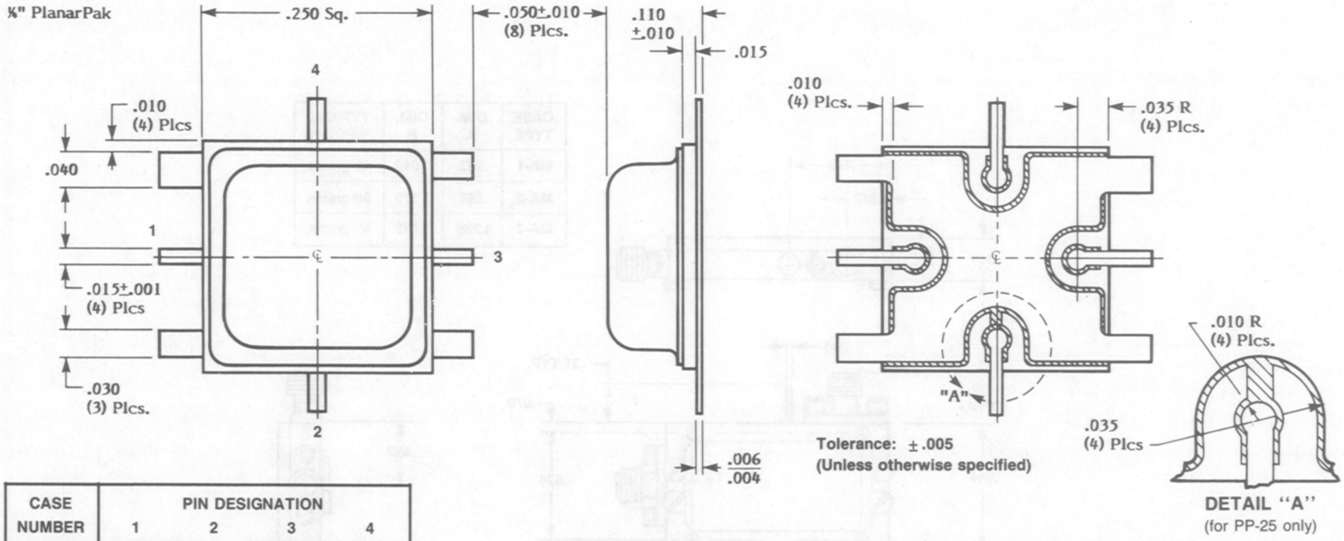


DIMENSIONS IN INCHES
TOLERANCES: XX ± .02
XXX ± .010

NOTE 1: USE CONNECTOR KITS SK-001 and SK-002

• PP-25 Case Drawings

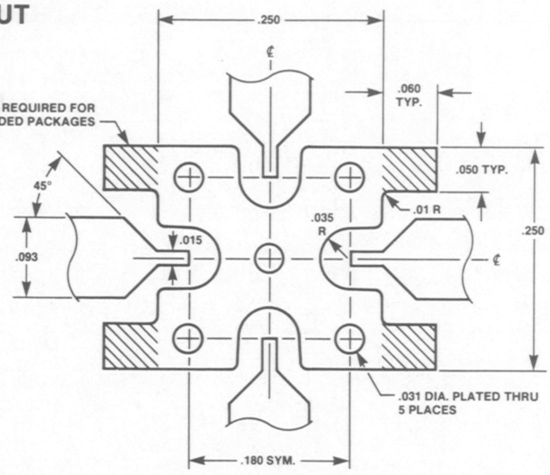
.25 × .25 PLANARPAK™ SURFACE MOUNTED COMPONENTS


¼" PlanarPak
.250 Sq.
.050±.010
(8) Plcs.
.110
±.010
.015
4
.010
(4) Plcs
.040
1
3
.015±.001
(4) Plcs
.030
(3) Plcs.
2
.006
.004
.010
(4) Plcs.
.035 R
(4) Plcs.
"A"
Tolerance: ±.005
(Unless otherwise specified)
.010 R
(4) Plcs.
.035
(4) Plcs
DETAIL "A"
(for PP-25 only)

Note: Leads are for testing only and may be trimmed flush at time of installation.

CASE NUMBER	PIN DESIGNATION 1	2	3	4
PP-25	RF In	Ground	RF Out	V_{BIAS}
PP-25F	RF In	$V_{CONTROL}$	RF Out	V_{BIAS}
PP-25S	J_1	$V_{CONTROL}$	J_2	J_0

RECOMMENDED BOARD LAYOUT


.250
℄
.060
TYP.
TABS REQUIRED FOR
LEADED PACKAGES
.050 TYP.
45°
.01 R
.035
R
.015
.093
.250
℄
.031 DIA. PLATED THRU
5 PLACES
.180 SYM.

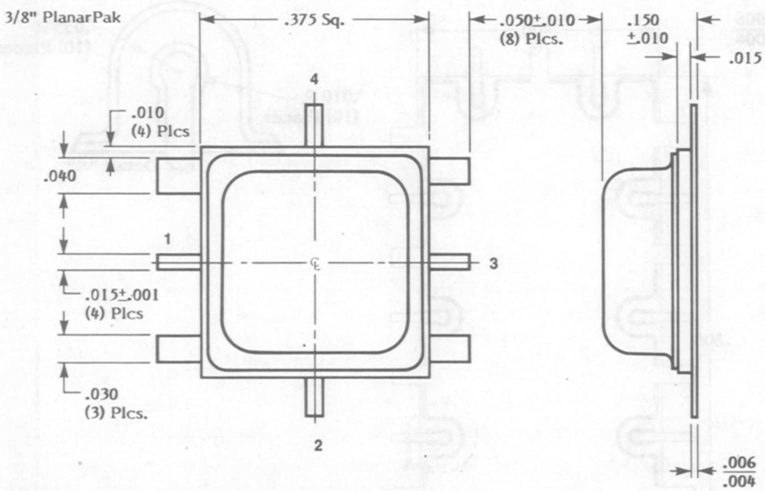
**BOARD MATERIAL: .031 THICK MAX.
EPOXY FIBERGLASS OR PTFE.
THIS LAYOUT IS RECOMMENDED FOR
APPLICATIONS BELOW 8 GHz.**

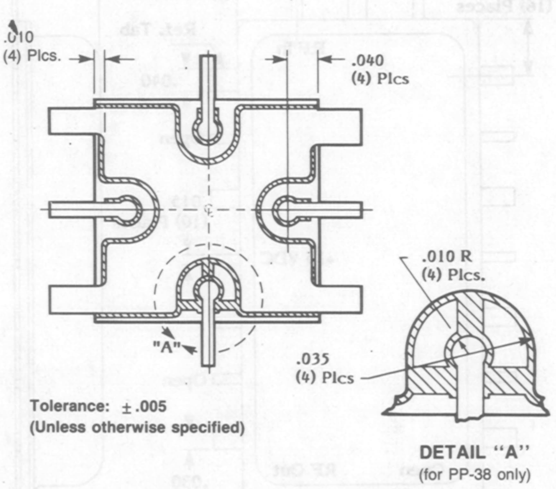
Recommended Assembly Procedure

1. Chemically clean the PC board and the unit to be mounted using a vapor degreaser or acetone followed by an isopropol alcohol wash. Do not use ultrasonic cleaning.
2. Mask the backside of the PC board to prevent solder from reflowing through the plated through-holes causing a rough ground plane surface. A suggested masking material is 2 mil thick Kapton® film with silicone adhesive back (Permacel part #P-222).
3. Apply solder cream (suggest Multicore SN62PRMAB3 or equivalent) using screen printing techniques or careful hand application. A layer 4-6 mils thick is adequate.
4. Reflow of the unit to the board may be done in many ways. Using a hot plate is one of the most simple. During reflow, pressure (with a clamping arrangement) on the unit is recommended, but not absolutely necessary. Absolute maximum reflow temperature is 260°C for not more than 10 seconds.
5. Chemically reclean the unit using the procedures given in step one. Make sure that a flux remover is used which is appropriate for the type of solder cream used (Multicore PC81 is the recommended flux remover for the above mentioned cream).

It should be noted that there are many alternatives for component attachment. This procedure has been found to be simple and effective.

.375 × .375 PLANARPAK™ SURFACE MOUNTED COMPONENTS


3/8" PlanarPak
.375 Sq.
.010
(4) Plcs
.040
.015±.001
(4) Plcs
.030
(3) Plcs.
1
2
3
4
.050±.010
(8) Plcs.
.150
±.010
.015
.006
.004

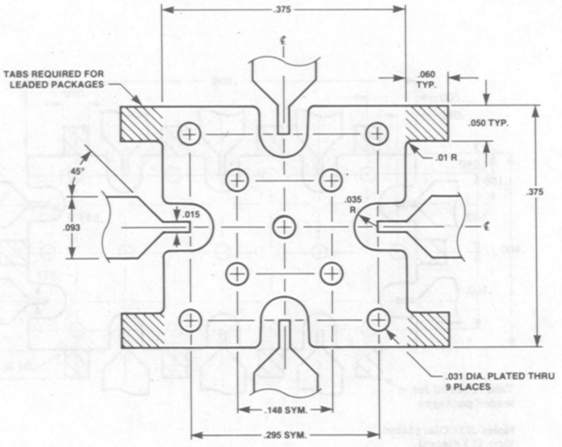

.010
(4) Plcs.
.040
(4) Plcs
"A"
.010 R
(4) Plcs.
.035
(4) Plcs
DETAIL "A"
(for PP-38 only)

Tolerance: ±.005
(Unless otherwise specified)

CASE NUMBER	PIN DESIGNATION 1	2	3	4
PP-38	RF In	Ground	RF Out	V_{BIAS}
PP-38M	RF	LO	IF	N/C

Note 1: Leads for testing only and may be trimmed flush at time of installation.
2: N/C = Not Connected.

RECOMMENDED BOARD LAYOUT


.375
℄
TABS REQUIRED FOR LEADED PACKAGES
.060
TYP.
.050 TYP.
.01 R
.375
45°
.093
.015
.035
R
℄
.031 DIA. PLATED THRU
9 PLACES
.148 SYM.
.295 SYM.

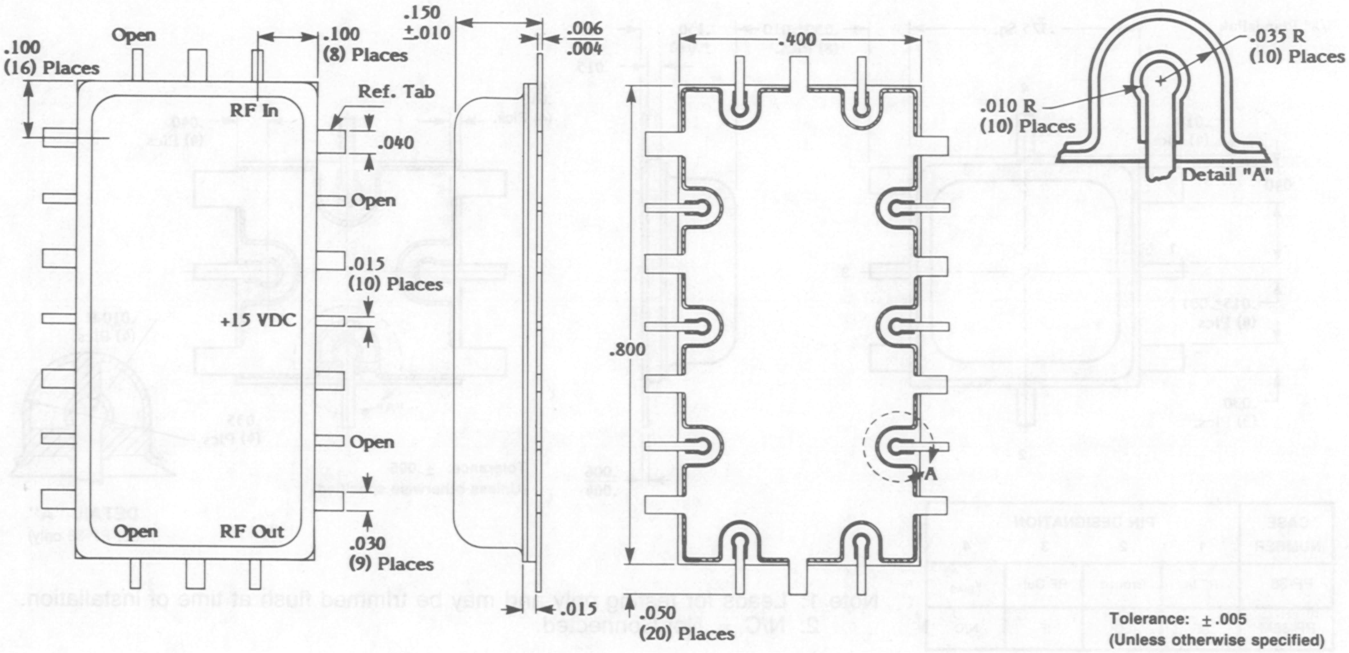
**BOARD MATERIAL: .031 THICK MAX.
EPOXY FIBERGLASS OR PTFE.
THIS LAYOUT IS RECOMMENDED FOR
APPLICATIONS BELOW 8 GHz.**

Recommended Assembly Procedure

1. Chemically clean the PC board and the unit to be mounted using a vapor degreaser or acetone followed by an isopropol alcohol wash. Do not use ultrasonic cleaning.
2. Mask the backside of the PC board to prevent solder from reflowing through the plated through-holes causing a rough ground plane surface. A suggested masking material is 2 mil thick Kapton® film with silicone adhesive back (Permacel part #P-222).
3. Apply solder cream (suggest Multicore SN62PRMAB3 or equivalent) using screen printing techniques or careful hand application. A layer 4-6 mils thick is adequate.
4. Reflow of the unit to the board may be done in many ways. Using a hot plate is one of the most simple. During reflow, pressure (with a clamping arrangement) on the unit is recommended, but not absolutely necessary. Absolute maximum reflow temperature is 260°C for not more than 10 seconds.
5. Chemically reclean the unit using the procedures given in step one. Make sure that a flux remover is used which is appropriate for the type of solder cream used (Multicore PC81 is the recommended flux remover for the above mentioned cream).

It should be noted that there are many alternatives for component attachment. This procedure has been found to be simple and effective.

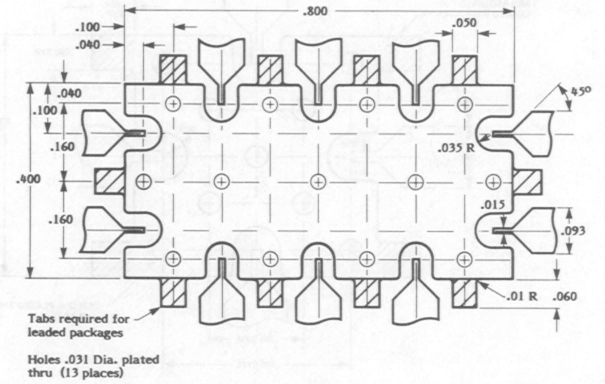
.4 × .8 PLANARPAK™ SURFACE MOUNT COMPONENTS


.100
(16) Places
Open
.100
(8) Places
.150
±.010
.006
.004
.400
Ref. Tab
RF In
.040
Open
.015
(10) Places
+15 VDC
Open
Open
RF Out
.030
(9) Places
.800
.015
.050
(20) Places
A
.035 R
(10) Places
.010 R
(10) Places
Detail "A"

Tolerance: ±.005
(Unless otherwise specified)

Note: Leads are for testing only and may be trimmed flush at time of installation.

RECOMMENDED BOARD LAYOUT


.800
.050
.100
.040
.040
.100
.160
.400
.160
45°
.035 R
.015
.093
.01 R
.060
Tabs required for leaded packages
Holes .031 Dia. plated thru (13 places)

BOARD MATERIAL: .031 THICK MAX.
EPOXY FIBERGLASS OR PTFE.
THIS LAYOUT IS RECOMMENDED FOR APPLICATIONS BELOW 8 GHz.

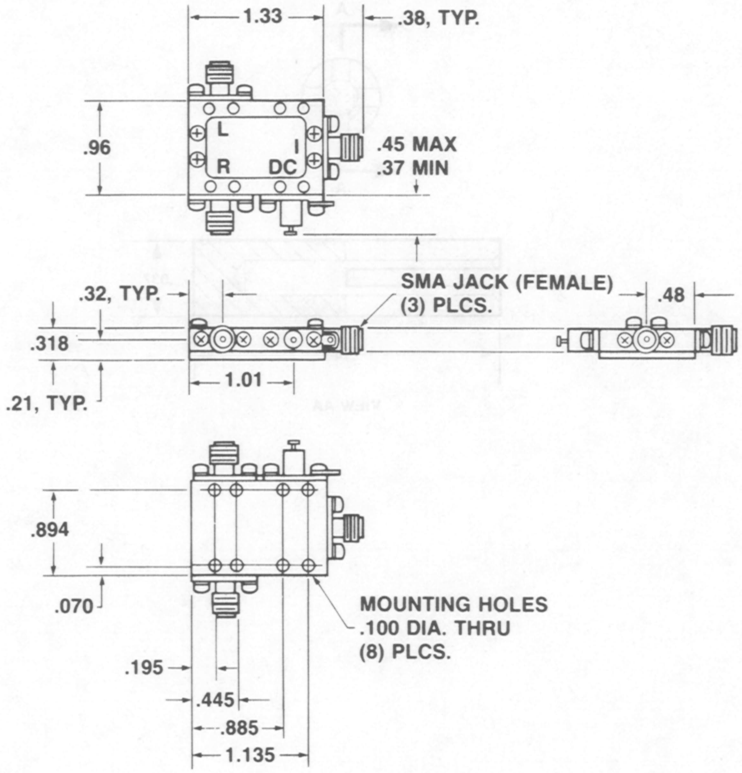
Recommended Assembly Procedure

1. Chemically clean the PC board and the unit to be mounted using a vapor degreaser or acetone followed by an isopropol alcohol wash. Do not use ultrasonic cleaning.
2. Mask the backside of the PC board to prevent solder from reflowing through the plated through-holes causing a rough ground plane surface. A suggested masking material is 2 mil thick Kapton® film with silicone adhesive back (Permacel part #P-222).
3. Apply solder cream (suggest Multicore SN62PRMAB3 or equivalent) using screen printing techniques or careful hand application. A layer 4-6 mils thick is adequate.
4. Reflow of the unit to the board may be done in many ways. Using a hot plate is one of the most simple. During reflow, pressure (with a clamping arrangement) on the unit is recommended, but not absolutely necessary. Absolute maximum reflow temperature is 260°C for not more than 10 seconds.
5. Chemically reclean the unit using the procedures given in step one. Make sure that a flux remover is used which is appropriate for the type of solder cream used (Multicore PC81 is the recommended flux remover for the above mentioned cream).

It should be noted that there are many alternatives for component attachment. This procedure has been found to be simple and effective.

• SA-1 Case Drawings

SA-1


1.33
.38, TYP.
L
I
R
DC
.96
.45 MAX
.37 MIN
SMA JACK (FEMALE)
(3) PLCS.
.32, TYP.
.48
.318
1.01
.21, TYP.
.894
.070
MOUNTING HOLES
.100 DIA. THRU
(8) PLCS.
.195
.445
.885
1.135

TYPICAL WEIGHT = 40 grams

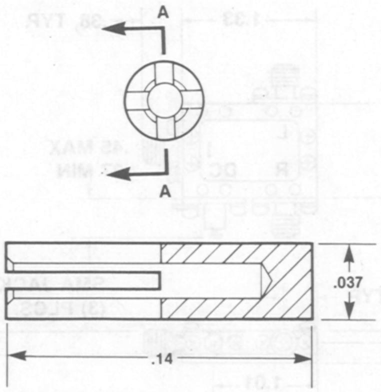
NOTES: (UNLESS OTHERWISE SPECIFIED)

DIMENSIONS IN INCHES
TOLERANCES: XX ±.02
XXX ±.010

NOTE: USE CONNECTOR KITS SK-001 AND SK-002

• Slip-On Sleeves SK-003 Case Drawings

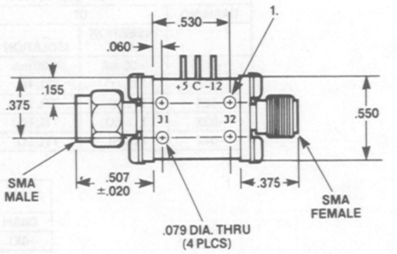
SLIP-ON SLEEVES SK-003



VIEW AA

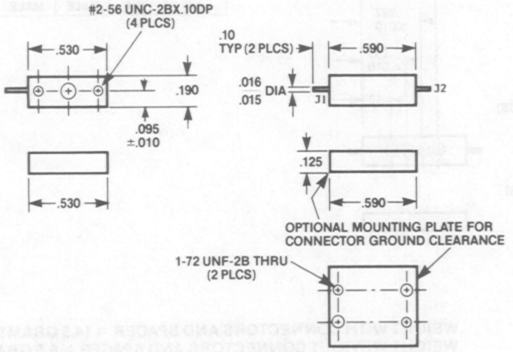
• SPST Case Drawings

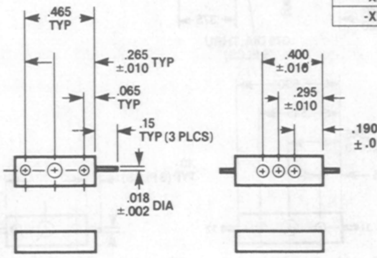
SPST


.530
1.
.060
+5 C -12
.155
.375
J1
J2
.550
SMA MALE
.507 ±.020
.375
SMA FEMALE
.079 DIA. THRU (4 PLCS)

DRIVER OPTION TABLE		
CONTROL INPUT C		
DASH NO.	INSERTION LOSS	ISOLATION
-X0X	−10V	+30 mA
-X1X	TTL LO	TTL HI
-X2X	TTL HI	TTL LO

CONNECTOR OPTION TABLE		
DASH NO.	J1	J2
-XX1	FEM	FEM
-XX2	NONE	NONE
-XX3	MALE	MALE
-XX4	MALE	FEM
-XX5	FEM	MALE


#2-56 UNC-2BX.10DP (4 PLCS)
.530
.190
.095 ±.010
.530
.10 TYP (2 PLCS)
.590
.016 .015 DIA
J1
J2
.125
.590
OPTIONAL MOUNTING PLATE FOR CONNECTOR GROUND CLEARANCE
1-72 UNF-2B THRU (2 PLCS)


.465 TYP
.265 ±.010 TYP
.065 TYP
.15 TYP (3 PLCS)
.018 ±.002 DIA
.400 ±.016
.295 ±.010
.190 ±.01

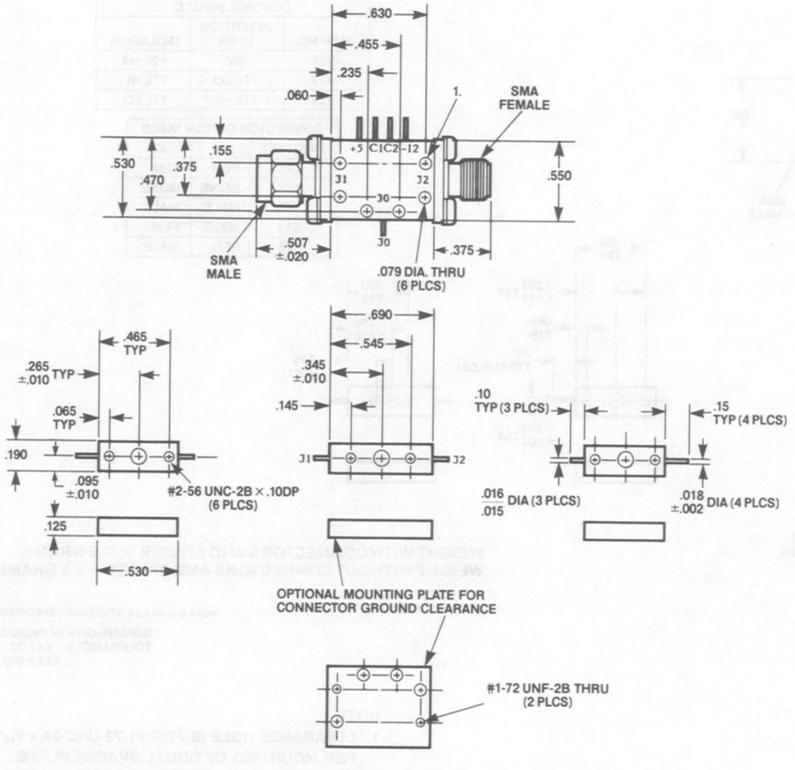
WEIGHT WITH CONNECTORS AND SPACER = 11.5 GRAMS
WEIGHT WITHOUT CONNECTORS AND SPACER = 5.5 GRAMS

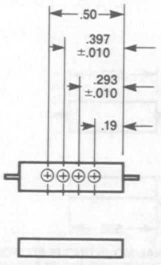
NOTES (UNLESS OTHERWISE SPECIFIED)
DIMENSIONS IN INCHES
TOLERANCES: XX ±.02
XXX ±.010

NOTE:
1. CLEARANCE HOLE IS FOR #1-72 UNC-2A × 5/16" FOR MOUNTING OPTIONAL SPACER PLATE.
2. USE CONNECTOR KITS SK-005 AND SK-006
3. SMA CONNECTORS OPTIONAL AT J1 AND J2, SHOWN FOR DIMENSIONAL PURPOSES.

• SPDT Case Drawings

SPDT


.630
.455
.235
.060
1.
SMA
FEMALE
+5 C1C2 -12
J1
J2
J0
.530
.375
.470
.155
.550
SMA
MALE
.507
±.020
.375
.079 DIA. THRU
(6 PLCS)
.465
TYP
.265
±.010 TYP
.065
TYP
.190
.095
±.010
#2-56 UNC-2B × .10DP
(6 PLCS)
.125
.530
.690
.545
.345
±.010
.145
J1
J2
.10
TYP (3 PLCS)
.15
TYP (4 PLCS)
.016
.015 DIA (3 PLCS)
.018
±.002 DIA (4 PLCS)
OPTIONAL MOUNTING PLATE FOR
CONNECTOR GROUND CLEARANCE
#1-72 UNF-2B THRU
(2 PLCS)


.50
.397
±.010
.293
±.010
.19

DRIVER OPTION TABLE				
DASH NO.	C1		C2	
	INSERTION LOSS	ISOLATION	INSERTION LOSS	ISOLATION
-00X	−30 mA	+30 mA	−30 mA	+30 mA
-01X	TTL LO	TTL HI	TTL LO	TTL HI
-02X	TTL HI	TTL LO	TTL HI	TTL LO
-03X	TTL LO	TTL HI	TTL HI	TTL LO
-04X	TTL HI	TTL LO	TTL LO	TTL HI

CONNECTOR OPTION TABLE			
DASH	J0	J1	J2
-0X1	FEM	FEM	FEM
-0X2	NONE	NONE	NONE
-0X3	MALE	MALE	MALE
-0X4	MALE	FEM	FEM
-0X5	FEM	MALE	MALE

WEIGHT WITH CONNECTORS AND SPACER = 14.5 GRAMS
WEIGHT WITHOUT CONNECTORS AND SPACER = 6.5 GRAMS

NOTES (UNLESS OTHERWISE SPECIFIED)

DIMENSIONS IN INCHES
TOLERANCES: XX ±.02
XXX ±.010

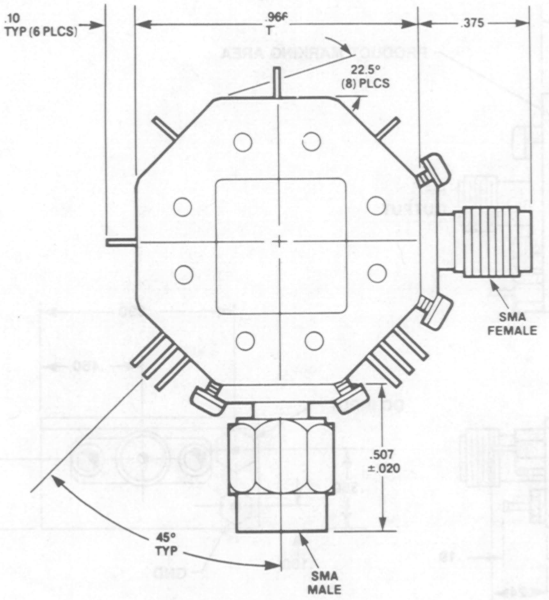
NOTE:

1. **CLEARANCE HOLE FOR 1-72 UNF-2A × 5/16″ FOR MOUNTING OPTIONAL SPACER PLATE.**
2. **CONNECTORS OPTIONAL, SHOWN FOR DIMENSIONAL PURPOSES.**

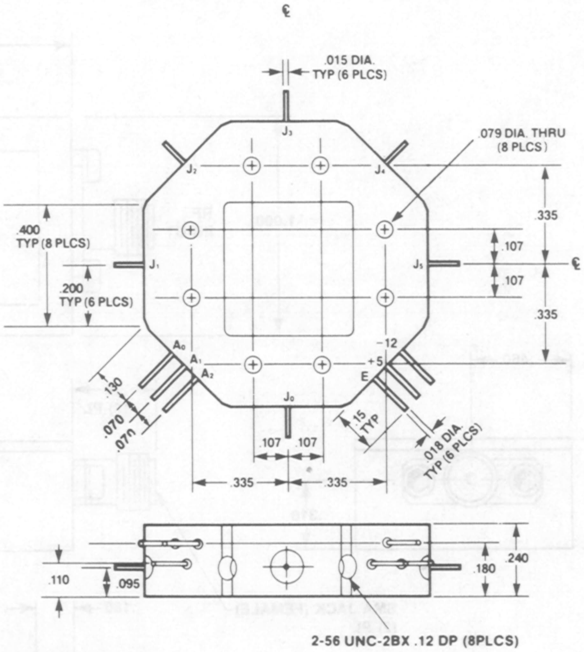
USE CONNECTOR KITS SK-005 AND SK-006

• SPMT Case Drawings

SPMT



.10
TYP (6 PLCS)
.966
.375
22.5°
(8) PLCS
SMA
FEMALE
.507
±.020
45°
TYP
SMA
MALE



℄
.015 DIA.
TYP (6 PLCS)
.079 DIA. THRU
(8 PLCS)
J₃
J₂
J₄
J₁
J₅
.400
TYP (8 PLCS)
.200
TYP (6 PLCS)
.335
.107
.107
.335
℄
A₀
A₁
A₂
−12
+5
E
J₀
.130
.070
.070
.15
TYP
.018 DIA.
TYP (6 PLCS)
.107
.107
.335
.335
.110
.095
.180
.240
2-56 UNC-2BX .12 DP (8PLCS)

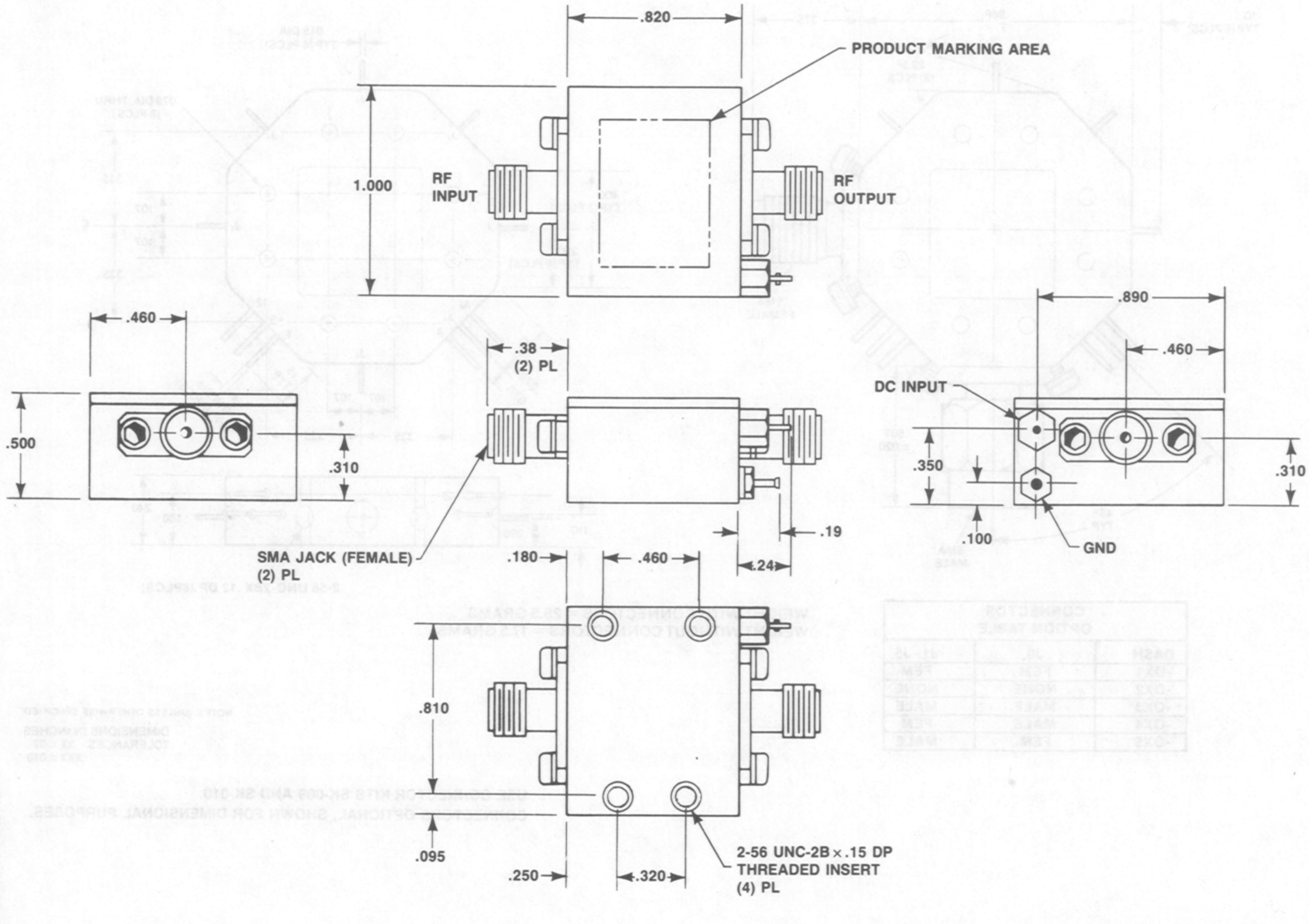
CONNECTOR OPTION TABLE		
DASH	J0	J1 - J5
-OX1	FEM	FEM
-OX2	NONE	NONE
-OX3	MALE	MALE
-OX4	MALE	FEM
-OX5	FEM	MALE

WEIGHT WITH CONNECTORS = 26.5 GRAMS
WEIGHT WITHOUT CONNECTORS = 17.5 GRAMS

NOTES: (UNLESS OTHERWISE SPECIFIED)
DIMENSIONS IN INCHES
TOLERANCES: XX ±.02
XXX ±.010

USE CONNECTOR KITS SK-009 AND SK-010.
CONNECTORS OPTIONAL, SHOWN FOR DIMENSIONAL PURPOSES.

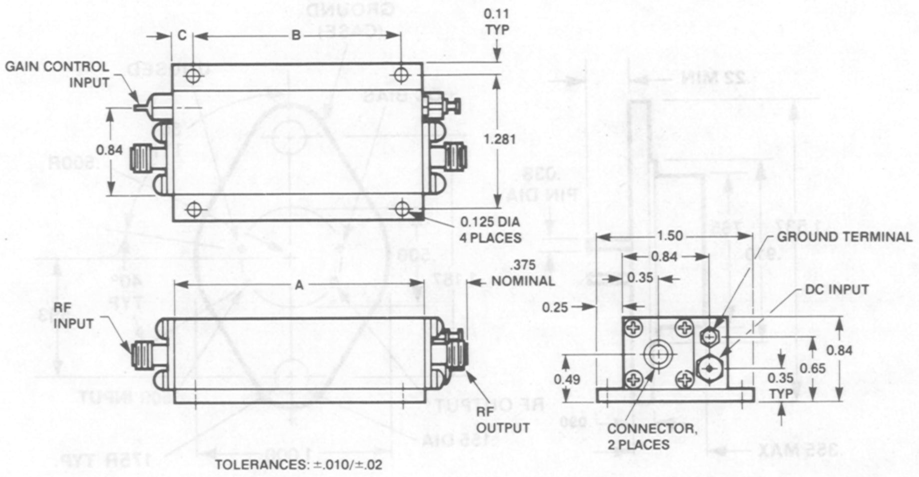
• TC 1 Case Drawings


.820
PRODUCT MARKING AREA
1.000
RF INPUT
RF OUTPUT
.460
.38 (2) PL
.890
.460
DC INPUT
.500
.310
.350
.310
.100
GND
SMA JACK (FEMALE) (2) PL
.19
.180
.460
.24
.810
.095
.250
.320
2-56 UNC-2B × .15 DP THREADED INSERT (4) PL

TYPICAL WEIGHT WITH CONNECTORS = 21.5 GRAMS

DIMENSIONS IN INCHES
TOLERANCES: XX ± .02
XXX × .010

• TC 2, TC 4
Case Drawings



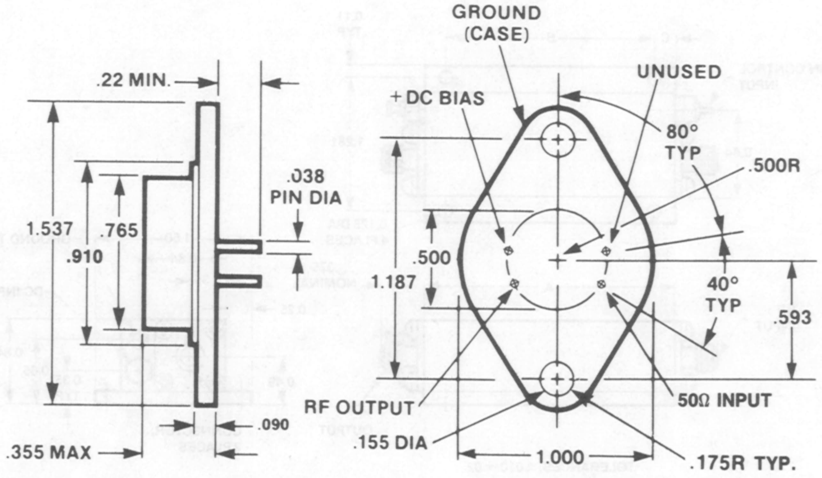
C
B
0.11
TYP
GAIN CONTROL
INPUT
1.281
0.84
0.125 DIA
4 PLACES
.375
NOMINAL
A
RF
INPUT
RF
OUTPUT
TOLERANCES: ±.010/±.02
1.50
0.84
0.35
0.25
GROUND TERMINAL
DC INPUT
0.84
0.65
0.35
TYP
0.49
CONNECTOR,
2 PLACES

CASE	DIMENSION A	DIMENSION B	DIMENSION C	APPROX. WEIGHT
TC-2	1.37	1.00	0.187	2 oz.
TC-4	2.40	2.00	0.202	4 oz.

CONNECTOR OPTION: SMA, N, TNC, BNC.

• TO-3 Case Drawings

TO-3

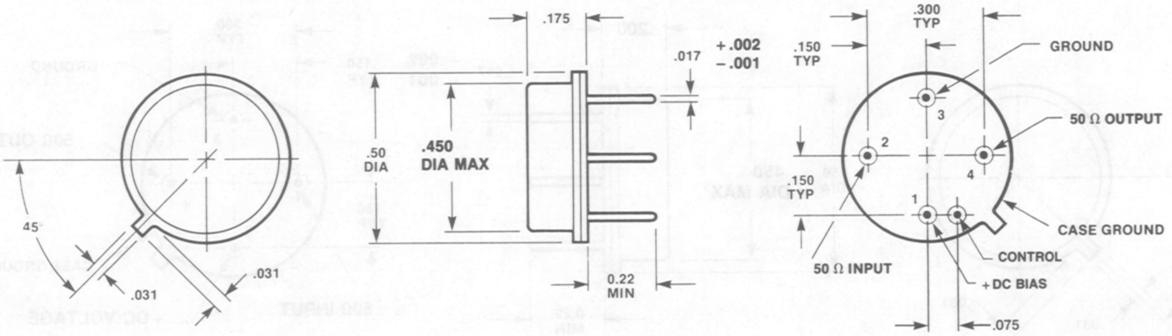

.22 MIN.
1.537
.765
.910
.038
PIN DIA
.355 MAX
.090
GROUND
(CASE)
UNUSED
+DC BIAS
80°
TYP
.500R
.500
1.187
40°
TYP
.593
RF OUTPUT
.155 DIA
50Ω INPUT
1.000
.175R TYP.

APPROXIMATE WEIGHT 0.5 oz. (14.5 grams)

DIMENSIONS IN INCHES
TOLERANCES: XX ± .02
XXX ± .010

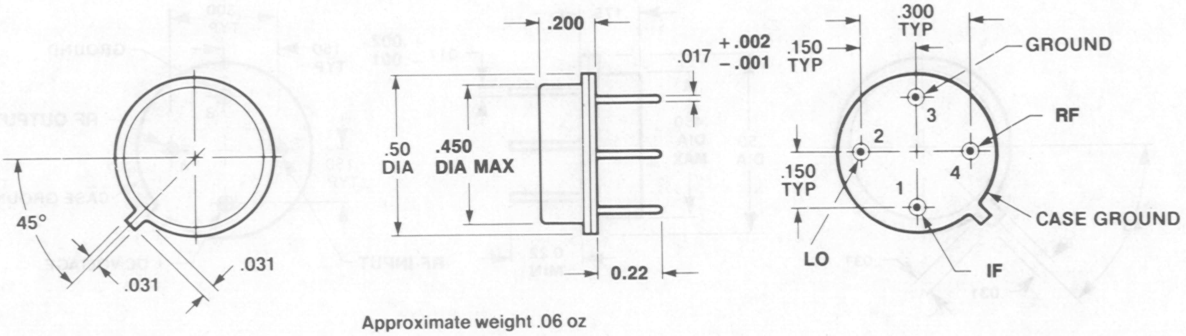
• TO-8F, TO-8M Case Drawings

TO-8F


45°
.031
.031
.175
.017
+.002
−.001
.50
DIA
.450
DIA MAX
0.22
MIN
.300
TYP
.150
TYP
GROUND
3
2
4
50 Ω OUTPUT
.150
TYP
1
CASE GROUND
CONTROL
50 Ω INPUT
+DC BIAS
.075

APPROXIMATE WEIGHT .06 oz.

TO-8M


45°
.031
.031
.200
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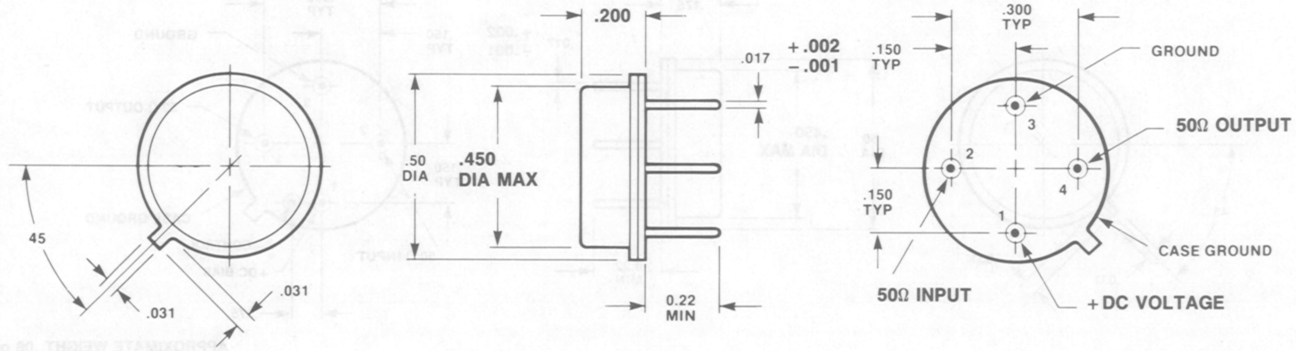
+.002
−.001
.50
DIA
.450
DIA MAX
0.22
.300
TYP
.150
TYP
GROUND
3
RF
2
4
.150
TYP
1
CASE GROUND
LO
IF

Approximate weight .06 oz

ALL DIMENSIONS IN INCHES
TOLERANCES: .XX ± .02
.XXX ± .010

• TO-8T, TO-8U
Case Drawings

TO-8T

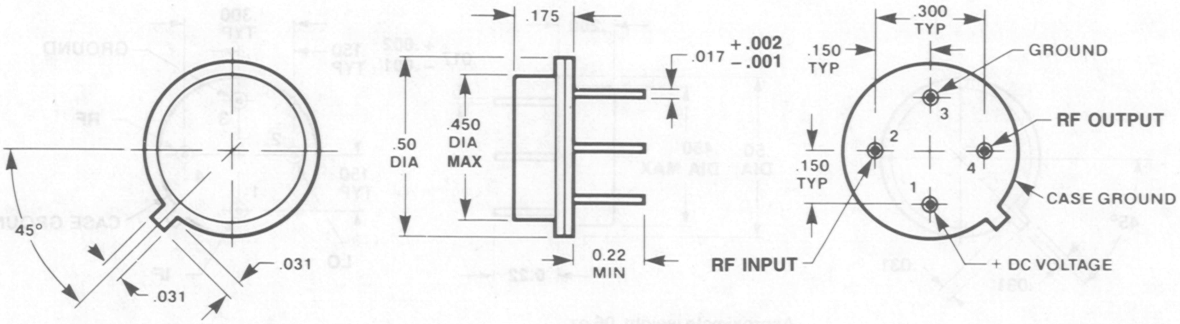


45
.031
.031
.200
.50
DIA
.450
DIA MAX
.017
+.002
−.001
0.22
MIN
.150
TYP
.300
TYP
GROUND
3
2
4
1
50Ω OUTPUT
.150
TYP
CASE GROUND
50Ω INPUT
+DC VOLTAGE

APPROXIMATE WEIGHT .06 oz

DIMENSION IN INCHES
TOLERANCES: .XX ± .02
.XXX ± .010

TO-8U

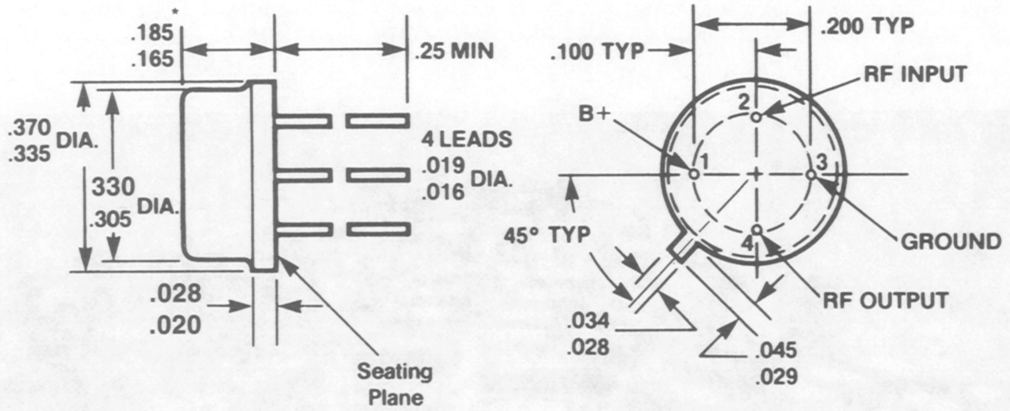


45°
.031
.031
.175
.50
DIA
.450
DIA
MAX
.017
+.002
−.001
0.22
MIN
.150
TYP
.300
TYP
GROUND
3
2
4
1
RF OUTPUT
.150
TYP
CASE GROUND
RF INPUT
+ DC VOLTAGE

APPROXIMATE WEIGHT 0.06 oz.

DIMENSIONS IN INCHES
TOLERANCES: XX ± .02
XXX ± .010

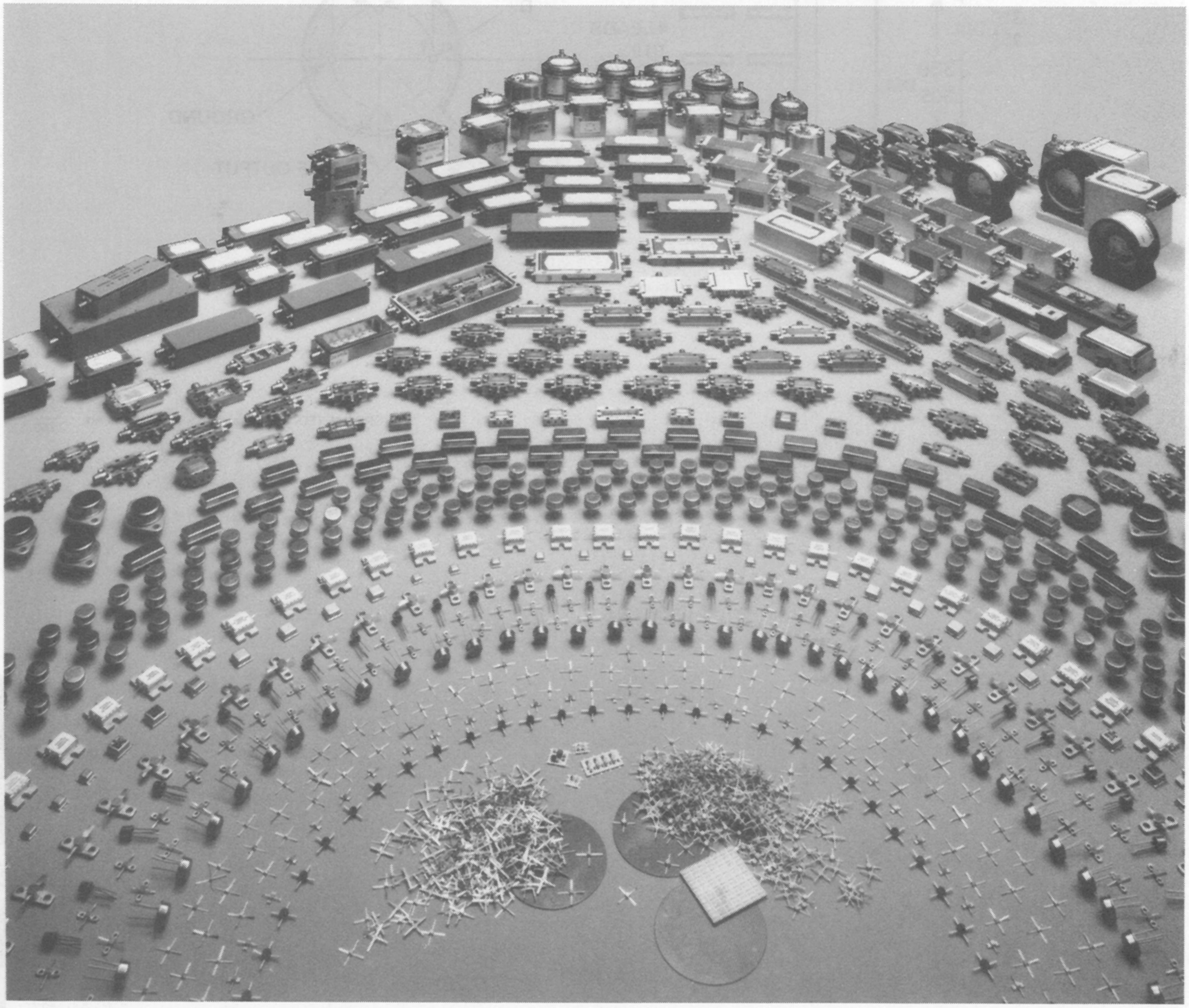
• TO-12 Case Drawings



.185*
.165
.25 MIN
.370
.335
DIA.
330
.305
DIA.
4 LEADS
.019
.016
DIA.
.028
.020
Seating Plane
.200 TYP
.100 TYP
RF INPUT
B+
2
1
3
4
45° TYP
GROUND
RF OUTPUT
.034
.028
.045
.029

*For GPD-405 (TO-12T Case) these dimensions are $\frac{.230}{.260}$

APPENDIX



• APPENDIX

Other Avantek Capabilities 410

Charts and Conversion Tables 414

Quality Assurance, Warranty & Ordering Information 418

Avantek Sales Office & Representatives 420

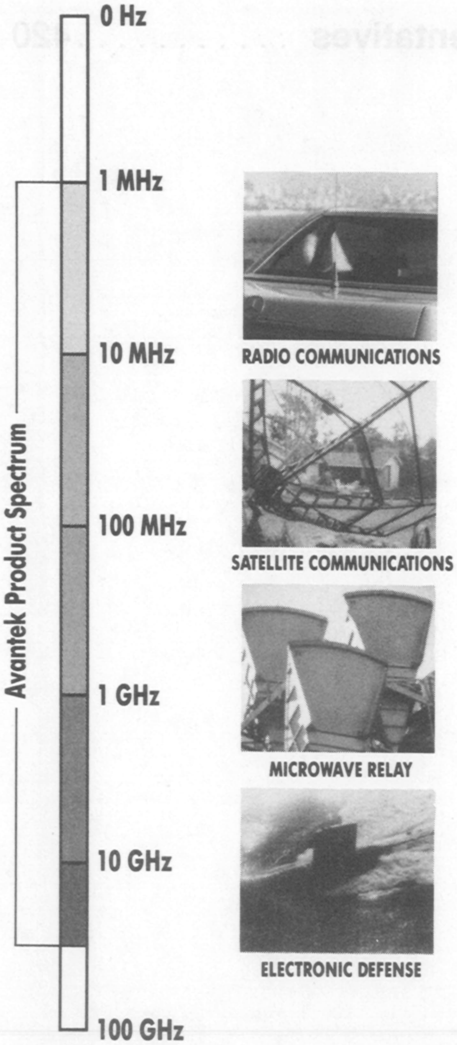
AVANTEK VERTICAL INTEGRATION

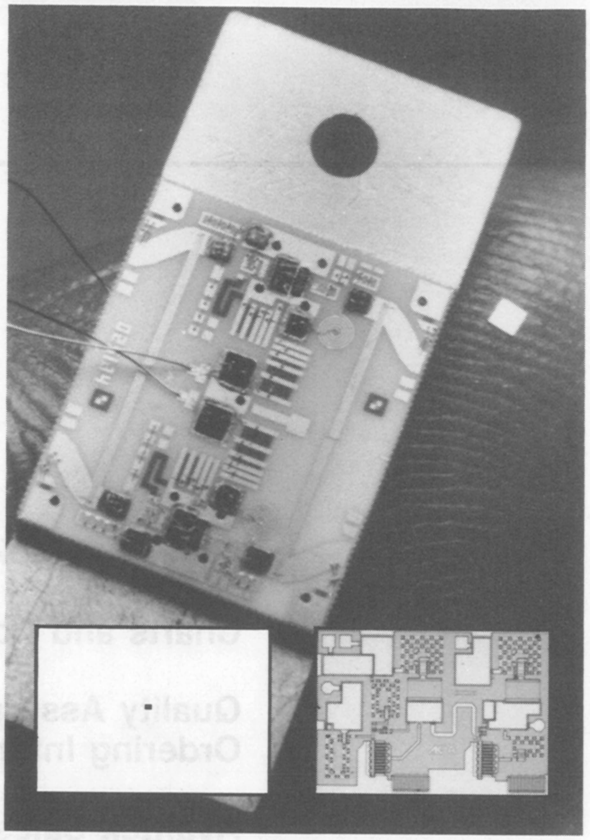
From Transistors and MMICs to complete Telecommunications Systems

1. Space-Age Technology:

- Silicon and GaAs Semiconductors
- Si and GaAs Monolithic Microwave Integrated Circuits (MMICs)
- Thin-film hybrid Microwave Integrated Circuits (MICs)
- Mixers and RF switches
- Digital microwave radio
- Satellite earth stations
- Fiber-optic communications
- Advanced fabrication technology
- Proprietary packaging

Frequency Spectrum Chart

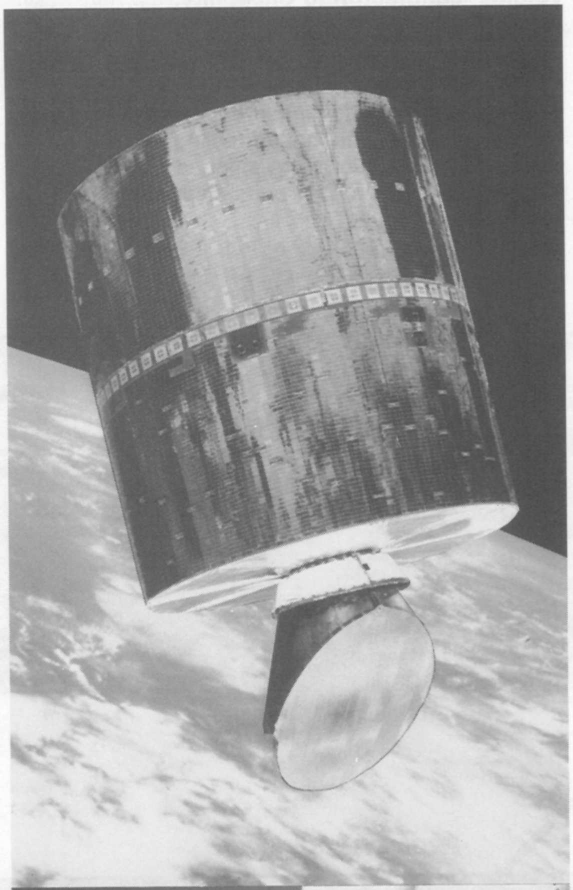


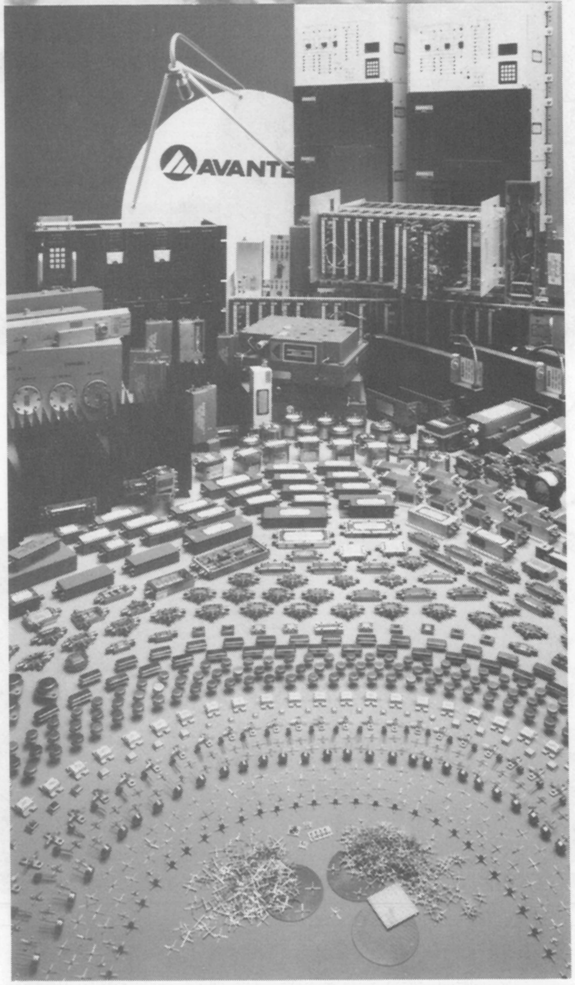


The tiny GaAs monolithic microwave integrated circuit performs the same basic function as the similar hybrid circuit in 1/25th the area and eliminates most circuit adjustments. Insets: The same MMIC shown actual size and enlarged 35 times.

2. Premium Product Performance:

- GaAs FETs operating beyond 45 GHz
- GaAs MMICs through 20 GHz
- Amplifiers through 44 GHz
- Widest oscillator and amplifier bandwidths
  - Only available 2-18, 18-40 GHz transistor amplifiers
  - Only available 18-26, 26-40 GHz transistor YTOs
- Lowest amplifier noise figures





3. High Quality/Reliability:

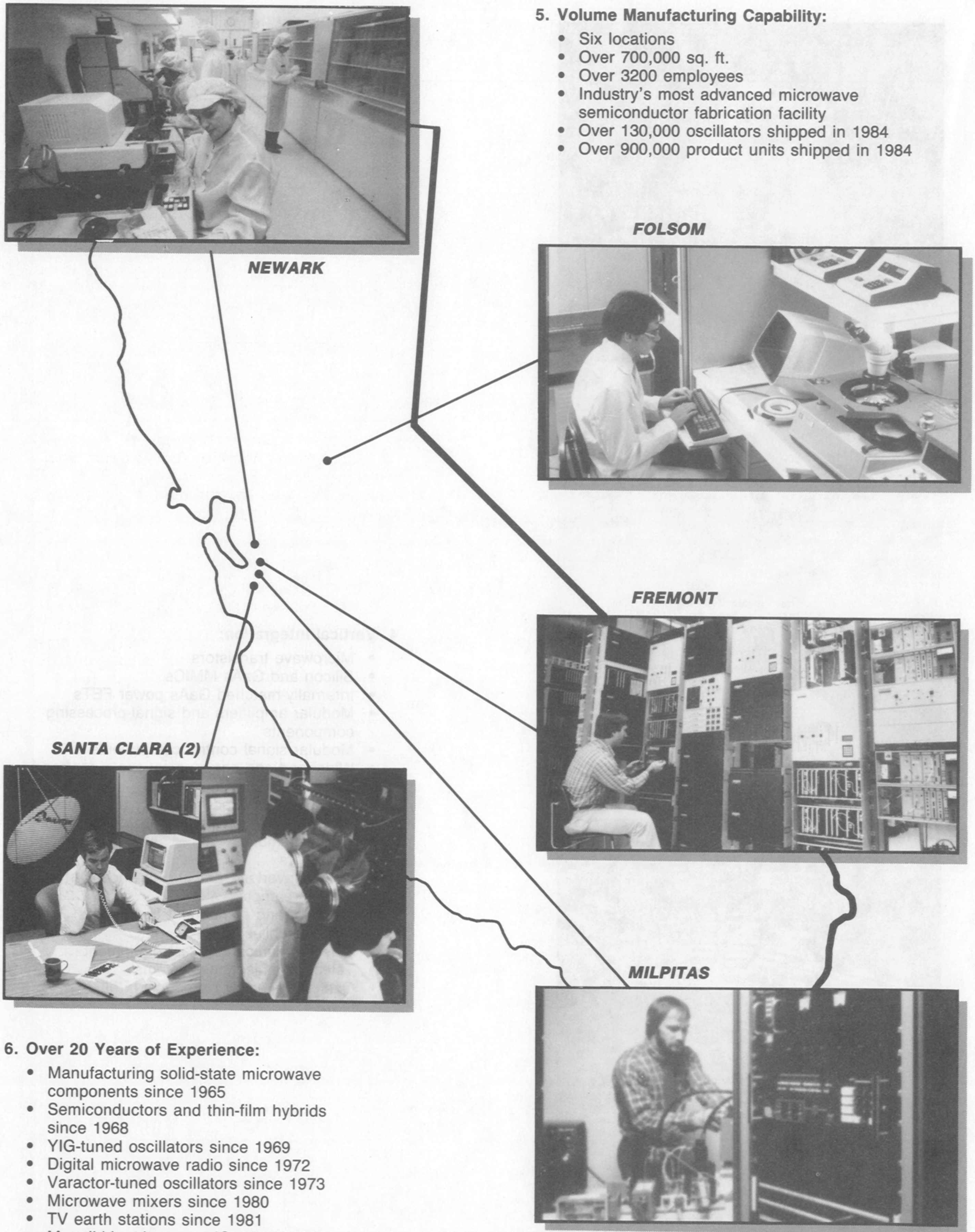
- Supplier to virtually all airborne electronic warfare systems
- Space-qualified products
- Integrated QA/AC system
- High-reliability screening available

4. Vertical Integration:

- Microwave transistors
- Silicon and GaAs MMICs
- Internally-matched GaAs power FETs
- Modular amplifiers and signal-processing components
- Modular signal control components
- Wideband and communications/radar-band amplifiers
- Variable- and fixed-frequency oscillators
- Digitally- and voltage-tuned oscillator and filter assemblies
- YIG filters
- Downconverters, amplifer-downconverters and mixer-preamps
- Thin-film and component functional subassemblies
- Telecommunications test equipment
- Telecommunications systems
- Over 600 standard products in all

5. Volume Manufacturing Capability:

- Six locations
- Over 700,000 sq. ft.
- Over 3200 employees
- Industry's most advanced microwave semiconductor fabrication facility
- Over 130,000 oscillators shipped in 1984
- Over 900,000 product units shipped in 1984



6. Over 20 Years of Experience:

- Manufacturing solid-state microwave components since 1965
- Semiconductors and thin-film hybrids since 1968
- YIG-tuned oscillators since 1969
- Digital microwave radio since 1972
- Varactor-tuned oscillators since 1973
- Microwave mixers since 1980
- TV earth stations since 1981
- Monolithic microwave ICs since 1982
- Digital earth stations since 1984
- Fiber Optic/Lightwave systems added in 1985

TWENTY YEARS of Solid State Leadership

Avantek, Inc. was founded in late 1965 to meet the electronic industry's need for high performance solid state VHF, UHF and microwave transistor amplifiers.

By December, 1965, the company had developed and introduced a family of low-noise solid state preamplifiers covering the 30 to 1000 MHz frequency range. Less than six months later, Avantek added solid state microwave amplifiers with octave band coverage through 2300 MHz as well as narrowband amplifiers for specific communications bands in that frequency range. This early family of highly reliable Avantek transistor amplifiers played a significant part in the microwave industry's decision to replace tube-type amplifiers with solid state.

Advances in solid state amplifier technology were hampered in these early years by the limited and sporadic availability of microwave transistors. Device suppliers simply were not able to keep pace with the progress made by Avantek circuit designers.

Consequently, in the spring of 1968, Avantek added the staff and facilities to design, develop annd manufacture its own gold-metallized planar epitaxial microwave transistors. The capability to design and produce high performance microwave transistors in-house is one of the important factors leading to Avantek's present success. Today, virtually every microwave transistor used in an Avantek product is an Avantek transistor. In 1968, Avantek also established a facility for the production of hybrid thin-film microwave integrated circuits (MICs).

In February, 1970, Avantek was granted a patent on the techniques of producing unconditionally-stable, cascadable wideband amplifier modules. This concept resulted in a wide variety of modular "gain blocks" in packages ranging from conventional cases with connectors to tiny thin-film modules in TO-8 and TO-12 transistor packages. To meet the needs of both the commercial and military user Avantek introduced thin-film fundamental YIG-tuned transistor oscillators in 1969. In 1973, varactor-tuned transistor oscillators were added to the growing component line. And, in 1980, Avantek developed and introduced a series of advanced wideband microwave mixers offering a remarkable combination of features.

In 1984, Avantek produced nearly 815,000 product units. Avantek's more than 3000 customers can now choose from over 600 company developed standard products.

Avantek is organized into three functional groups:

- **Microwave Semiconductor Group** — Develops and produces high-performance microwave transistors, diodes and monolithic integrated circuits which are used in virtually all Avantek products and most of which are also sold to outside customers.
- **Microwave Products Group** — Develops and manufactures amplifiers, mixers, control devices, YIG oscillators and filters, varactor and dielectrically-tuned oscillators and multi-function integrated assemblies.
- **Telecommunications Group** — Develops and manufactures equipment such as digital microwave radios, satellite earth station video receivers and digital earth terminals as well as high-performance amplifiers and functional supercomponents particularly optimized for telecommunications applications.

Today the Avantek microwave product line includes:

- Microwave Semiconductors:
  - Silicon Transistors
  - Gallium Arsenide Field Effect Transistors
  - Monolithic Microwave Integrated Circuits
  - Internally Matched GaAs FETs
- Avanpak™ Miniature Flatpack Products
- PlanarPak™ Surface Mounted Products
- Control Components:
  - Mixers
  - Switches
  - Limiters
  - Attenuators
- YIG-Tuned Oscillators and Filters
- Varactor-Tuned Oscillators
- Dielectrically-Stabilized Oscillators
- Wideband Microwave Amplifiers
- Low Noise Communications Amplifiers
- Medium Power Amplifiers
- Modular Amplifiers
- Special Purpose Amplifiers including:
  - TWT Retrofit Power Amplifiers for Microwave Radios
  - Cellular Radio Base Station Amplifiers
- Multifunction Integrated Assemblies
- INMARSAT RF Transceiver
- Microwave Digital Radios
- Satellite Earth Terminals
- Lightwave/Fiber Optic Systems

These products cover frequencies from DC to over 40 GHz for use in electronic warfare and radar, missiles and satellites, test equipment and instrumentation and various types of communications equipment for the military, commercial, industrial and consumer markets, both domestic and international.

Avantek Employees and Facilities: Today, there are over 3200 employees in the Avantek family supported by some of the industry's most modern equipment and facilities. Manufacturing, engineering and administrative facilities, all located in California, include 255,000 sq. ft. in Santa Clara, 180,000 sq. ft. in Milpitas, an 88,000 sq. ft. engineering and manufacturing facility in Folsom, a 91,000 sq. ft. Telecommunications Group facility in Fremont, and a 90,000 sq. ft. microwave semiconductor fabrication facility in Newark. This staff and floorspace supports Avantek's fundamental vertical integration strategy: to manufacture high-performance microwave transistors and monolithic circuits, to build these components into amplifiers and other functional "blocks," to integrate these various blocks into multifunction assemblies, to provide complete equipment and ready-to-operate "turnkey" telecommunications systems — and to support all products with research, engineering, quality control and customer support.

Other Avantek Capabilities

MICROWAVE TRANSISTORS

Avantek offers an ever-expanding line of VHF, UHF and microwave transistors. The packaged silicon planar epitaxial transistors combine high gain, low noise figures and wide dynamic range for applications up to approximately 6 GHz. Special attention is paid in the transistor family to the industry's need for wide dynamic range VHF-UHF transistors and for moderate power devices.

Avantek's range of Gallium Arsenide Field Effect Transistors (GaAs FETs) includes low-noise, high gain versions operating from a few MHz through approximately 15 GHz; moderate power versions; special oscillator types and dual-gate GaAs FETs which offer improved performance in limiting, gain-control and active mixing applications.

MODAMP™ MONOLITHIC MICROWAVE ICs

Avantek now has more than 37 different models in its steadily increasing series of MODAMP™ silicon monolithic integrated circuits (MMICs) including very low-cost plastic packaged versions for use from DC to 3 GHz.

IMFET™ INTERNALLY MATCHED GaAs FETs

Avantek supplies IMFET™ Internally Matched GaAs FETs providing output powers of up to 8 watts typical, which are optimized for specific communications frequency bands between 2.9 and 14.5 GHz. These power amplifier modules contain all necessary matching circuitry to allow them to be used in a 50 ohm circuit without external tuning.

AVANPAK™ MINIATURE FLATPACK AMPLIFIERS

Consisting of an ever-growing series in a unique Avantek-developed miniature microwave flatpack, Avanpak microwave amplifiers may be used with equal performance in limiting amplifiers, temperature-compensated amplifiers and amplifiers packaged to directly replace traveling wave tube (TWT) amplifiers in existing systems.

LOW NOISE COMMUNICATIONS/RADAR AMPLIFIERS

A complete range of low noise communications and radar preamplifiers is also available for every frequency band through 15 GHz and a 20.2-21.2 GHz unit for the MILSTAR military satellite communications system has been developed.

MEDIUM POWER AMPLIFIERS

Avantek is continually adding to its family of medium power amplifiers for both wideband and narrowband (communications) applications. The product line includes many different amplifiers and provide 1 to 10 watts of output power in satellite uplink and point-to-point communications bands as well as broad-band coverage through 12.4 GHz.

WIDEBAND MICROWAVE AMPLIFIERS

Using the latest generations of GaAs FETs, silicon bipolar transistors and MMICs, Avantek amplifiers are currently available with state-of-the-art noise figures and a wide selection of gain levels in the 500 MHz through 40 GHz frequency range. These amplifiers offer proven dependability in military ECM and radar systems and their lightweight, hermetic packages make them ideal for compact airborne systems.

Many other lightweight, hermetically-sealed wideband amplifiers using combinations of GaAs FET and bipolar transistors are also available.

All Avantek modular amplifiers are unconditionally stable, offer guaranteed performance and high reliability. A complete range of complementary components such as voltage-controlled attenuators and limiters, mixers, cases, printed circuit boards and hardware is also available for total subsystem integration.

OSCILLATORS

- Economical miniature varactor tuned oscillators in TO-8 packages
- Narrowband low-noise VCOs
- Multi-octave YIG-tuned oscillators and filters
- Mixed frequency dielectrically stabilized oscillators
- Complex assemblies containing multiple oscillators with associated functional and control circuitry
- Digital and analog drivers.

INTEGRATED SUBASSEMBLIES AND "SUPERCOMPONENTS"

In addition to supplying one of the industry's widest lines of solid-state microwave and millimeter-wave components, Avantek is also committed providing a broad capability of integrating these components into complete, functional subassemblies. An Avantek integrated subassembly offers a number of significant advantages to the customer, including:

- Minimizing outside vendor problems, which means a much higher probability of on-time delivery and fewer potential technical problems.
- Better subassembly performance margins based upon Avantek's superior component performance.
- Smaller size due to the elimination of interconnects and reduction of components dimensions.
- Higher reliability due to strict Avantek workmanship standards and precision thin-film implementation.
- Cost-effective production, with an emphasis on repeatability and process control.
- More gain per unit area which results in smaller size, less variation in gain over temperature and less power dissipation.
- Consistently lower noise figure because of Avantek FETs which exhibit the lowest noise figure in the microwave industry on a consistent, repeatable basis in production quantities.
- Lower risk because Avantek will not commit to a specification unless it is really achievable.
- A producible design which can be manufactured in large quantities on a consistent, repeatable basis.
- Military qualification to applicable standards.
- Program support and management.

Avantek is currently incorporating two innovative state-of-the-art MMIC chips into its products: 1) a GaAs FET distributed amplifier covering 2-18 GHz and 2) a high gain feedback amplifier covering 2-12 GHz. Avantek also has started a GaAs MMIC design effort devoted to specific functions needed for subassembly applications. Avantek has also developed a strong filter design synthesis capability which allows implementation of both narrowband and broadband filters on thin-film substrates, with minimum development time.

Avantek subassemblies are of two basic types: Thin-film and discrete. The thin-film (or hybrid MIC) subassemblies use Avantek unpackaged chip transistors, which are optimized for performance in a hybrid configuration without package parasitics, and an advanced thin-film process technology. Thin-film construction routinely produces circuits in volume using advanced techniques such as vacuum deposition and laser trimming of resistor networks, automated wire bonding, and laser drilling of plated through holes. The discrete subassemblies are integrated using either coaxial cables or soft board interconnect technology, which provides highly flexible and economical subassembly integration. They take advantage of the latest Avantek state-of-the-art packaged components including standard and special function blocks and semiconductor devices.

THIN-FILM SUBASSEMBLIES

The single most significant criterion for implementing a microwave function in a thin-film integrated subassembly is small size. The volume occupied by discrete microwave components which are interconnected by semi-rigid coax, can be significantly reduced by connectorless integration into a single machined housing. The fact that all functions are implemented with thin-film circuitry makes this size reduction even more dramatic.

Avantek's capabilities in the thin-film subassemblies area include the following:

- Microwave front-end assemblies containing switches, filters, mixers, amplifiers, multipliers, couplers, attenuators, etc.
- Phase and/or amplitude matched multichannel microwave front-end assemblies including the LO distribution chain.
- Up/down converters containing FET preamplifiers, filters, mixers, with LO distribution including multipliers and limiting amplifiers.
- Gain block subassemblies containing FET preamplifiers, filters, switched or analog attenuators, power dividers, couplers, etc.
- Avantek offers a standard product line of mixer-preamps which are available in our Avanpak™ miniature microwave flatpack. This MXA series has the options of 1, 2 or 3 stages of amplification. Modifications, such as the addition of filters, are quoted under an SXA series designation. Avantek also plans to introduce a line of standard "block" converter packages with preamplification ahead of the mixers in 1986.

VOLTAGE-CONTROLLED OSCILLATOR SUBASSEMBLIES

Avantek can also supply complete voltage-controlled oscillator subassemblies and supercomponents for critical airborne electronic defense applications, combining reliable Avantek thin-film varactor-tuned oscillators with a variety of support functions in a compact package. These assemblies are presently available for operation throughout the 2 to 18 GHz frequency range in narrowband versions with fast settling time, and in versions with octave and multi-octave bandwidths incorporating oscillator switching when necessary. Avantek VCO subassemblies can be supplied with digital tuning (coding to meet system parameters); PROM linearization; temperature compensation; multiple-coupled outputs and are packaged as form, fit and function replacements for existing VCO subassemblies. All units can be qualified to military specifications.

DISCRETE SUBASSEMBLIES

Discrete component integration lends itself to a wide variety of applications with design flexibility, simplified upgrading and greater ease of repair at the packaged component level. Discrete component based assembly size can be minimized through the use of connectorless packages such as Avanpak™ mixers, switches, amplifiers and PlanarPak™ cascadable amplifiers. All components with active devices are hermetically sealed at either the semiconductor or microwave component level. The resulting discrete subassemblies are useable in a wide variety of military and commercial environments including ground and shipboard based as well as airborne.

The Oscillator and Signal Processing division is presently manufacturing the following products:

- Phased-array receiving preamp module incorporating switches, filters, and low noise amplifiers.
- Maritime satellite transceiver assembly including LNA, class C power amplifier, diplexer, LO multiplication, transmit upconversion, and receive down conversion.
- Multi-channel EW receiver assembly which includes LNAs, wideband YIG filters, power dividers, detectors, switches, ECL circuitry and digital control for multiple active components. This unit is fabricated in a standard 19 inch rack mount configuration and includes power supply and cooling function.

INTEGRATED SUBASSEMBLIES AND "SUPERCOMPONENTS" (continued)

- Dual channel, phase matched radar, low noise amplifiers for ship board application. This unit includes limiters and multiple gain-state control functions.

AVANTEK ADVANTAGES

- The broad base of Avantek standard microwave components, coupled with the high level of component design expertise resident in the various product areas, provides the subsystem designer with the best system building blocks available in the world today.
- The high level of vertical integration combined with the large component production volume assures a reliable supply of microwave components.
- Avantek design expertise and easy access to component knowledge in the various product divisions, assures our customers the most effective component selection and system design to meet the overall requirements.

The bottom line is that Avantek is a high quality, low risk supplier of microwave components and subassemblies.

Please contact Avantek Component Sales to discuss your specific component and subassembly requirements.

COMMERCIAL COMMUNICATIONS PRODUCTS

Avantek manufactures a variety of components for use in satellite transmission systems. For consumer use, Avantek is the largest domestic manufacturer of Low Noise Amplifiers for use in TV receive only satellite receiving systems. They mount directly at the focal point of the dish antenna and provide reliable all weather operation. These LNAs are also used by thousands of cable TV and CATV systems around the country to receive their satellite programming. Other products such as block downconverters, LNA/block downconverter combinations, power dividers/combiners, signal duplexers and line booster amplifiers for TVRO applications are also manufactured.

At the other end of the spectrum, Avantek is currently supplying all ABC affiliate TV stations with the AR2000, receiving system designed for studio quality reception of primary and standby channels of satellite relayed network programming. Triple redundancy provides automatic switching to standby components in the event of a failure of virtually any component in the system, even the antenna.

Avantek also produces amplifiers and subassemblies to upgrade analog microwave radio equipment such as the microwave repeater facilities that dot the countryside. This is done by replacing the tube-type transmitter and receiver assemblies, that have been in service for many years, with far more reliable and cost-effective solid-state counterparts. Avantek is a major suppliier to the rapidly-growing cellular radio market with a 7-45 watt transistor base station amplifier and a separate receiver/preamplifier, each designed specifically for mobile radio communications.

The new Avantek ASAT-1214 Ku-band small aperture transmit/receive terminal provides a new solution to business communications problems. The ASAT-1214 comes complete with a microwave terminal, modulator/demodulator and antenna assembly making communications between distant locations easy and affordable. This small terminal can be installed easily and conveniently on the user's premises providing the flexibility to tailor a network to meet a customer's requirements. Less than five feet tall, this lightweight unit can be installed on a roof, in a parking lot, or anywhere that best suits the user's needs. Potential applications include data distribution, oil well and pipeline monitoring, electronic funds transferral, video conferencing, and voice storeandforward communications to name a few.

For further information on Avantek Commercial Communication Products, please call (408) 946-3080.

DIGITAL AND ANALOG LIGHTWAVE SYSTEMS

Avantek manufactures digital and analog lightwave transmission systems for metropolitan distribution of voice, data, and video channels. These fiber optic systems, which complement Avantek's line of digital microwave radios, provide telecommunications common carriers and private network users with cost-effective transmission facilities for local communications requirements.

The Ametrocom™ DLW-2 digital lightwave system can transmit up to eight DS-1 (1.544 Mbps) signals containing wide bandwidth digital services over fiber optic cable for repeaterless distances of over 60 kilometers.

The Ametrocom ALW-600 and ALW-960 analog lightwave systems permit the extension of analog baseband voice or video signals over fiber optic cable for repeaterless distances of over 40 kilometers. The Ametrocom ALW-600 tranmits up to 600 FDM voice channels; the Ametrocom ALW-960 can transmit up to 960 voice channels.

The Ametrocom ALW-V1/V2 analog video lightwave system provides broadcast quality video and audio transmission over multimode or singlemode fiber optic cable. The Ametrocom ALW-V1 transmits one video channel and two audio channels; the ALW-V2 provides transmission of a video baseband of up to 10 MHz. Repeaterless distances of up to 37 kilometers can be achieved.

Avantek Lightwave Systems provides extensive customer support and services. For further information please contact Avantek Lightwave Systems at (408) 943-4410.

DIGITAL MICROWAVE RADIOS

Avantek manufacturers a variety of microwave digital radio terminals and repeaters for the transmission of digitally encoded voice or data in the 2, 4, 6, 18 and 23 GHz frequency bands. Models are available that satisfy FCC Rules Part 21 for operation of point-to-point microwave radio in the common carrier frequency bands as well as Part 94 for operation in the private operational fixed service frequency bands. Specialized products operating in the narrow 2 GHz band are available for use by businesses such as banks, insurance companies and retailers. Other models are specifically designed to meet the requirements of the Federal Government.

These radio systems can transmit up to 672 voice and/or data channels simultaneously with transmission rates as high as 45 Mbps. The DR18A-672 operates in both common carrier and operational fixed service frequency bands with 672 voice and/or data channels with a transmission rate of 45 Mbps.

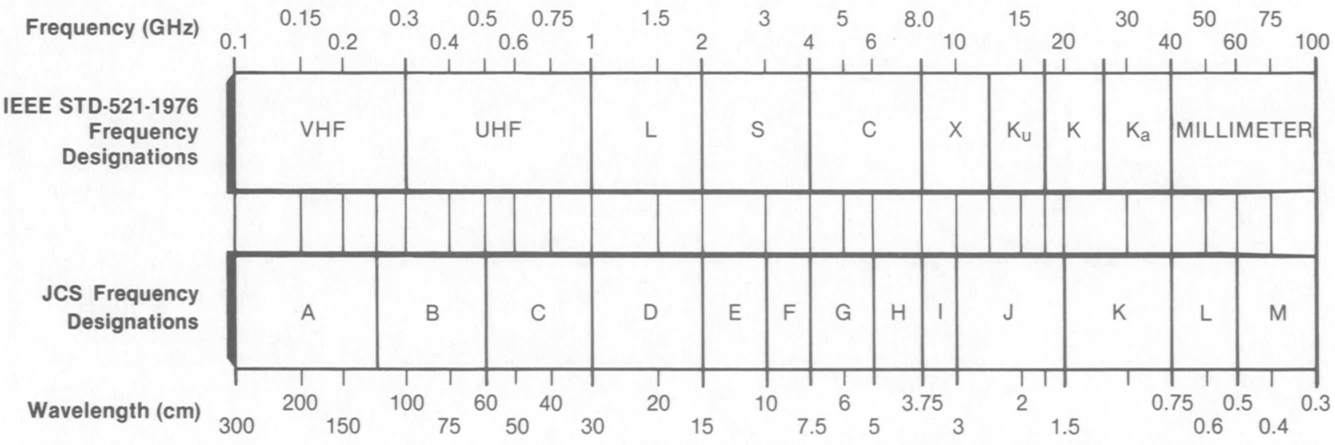
Avantek can provide a complete service to customers ranging from consultation to determine the proper system configuration to a complete "turnkey" offering in which Avantek, acting as prime contractor, engineers, furnishes and installs a complete microwave radio system such that the customer need to nothing but count the savings realized through a privately owned digitally microwave radio systems.

For further information on Avantek Microwave Digital Radio Systems please call (408) 946-3080.

NOTES:

Charts and Converison Tables

Frequency Designation Chart


Frequency (GHz)
0.1
0.15
0.2
0.3
0.4
0.5
0.6
0.75
1
1.5
2
3
4
5
6
8.0
10
15
20
30
40
50
60
75
100
IEEE STD-521-1976 Frequency Designations
VHF
UHF
L
S
C
X
Ku
K
Ka
MILLIMETER
JCS Frequency Designations
A
B
C
D
E
F
G
H
I
J
K
L
M
Wavelength (cm)
300
200
150
100
75
60
50
40
30
20
15
10
7.5
6
5
3.75
3
2
1.5
0.75
0.6
0.5
0.4
0.3

Noise Figure of Cascades

The overall noise figure of a cascade can be calculated with the equations:

$$F_C = F_1 + \frac{F_2 - 1}{G_1} + \frac{F_3 - 1}{G_1 G_2} + \dots + \frac{F_n - 1}{G_1 G_2 \dots G_{n-1}}$$

where F_n = Noise figure of the nth stage expressed as a numeric

G_n = Gain (in numeric ratio form) of the nth stage

F_c = Noise figure of the cascade

NF = Noise Figure in dB = $10 \log_{10} F$

Second-Stage Noise Figure Contribution — dB

First Stage		Second Stage Noise Figure						
Gain dB	Noise Figure dB	3 dB	5 dB	8 dB	10 dB	12 dB	15 dB	20 dB
20 dB	8.0	0.007	0.015	0.040	0.060	0.100	0.206	0.633
	5.0	0.014	0.030	0.070	0.120	0.200	0.401	1.183
	3.0	0.022	0.050	0.110	0.190	0.310	0.620	1.750
	1.5	0.039	0.070	0.160	0.270	0.430	0.852	2.307
15 dB	8.0	0.220	0.047	0.114	0.190	0.310	0.620	1.750
	5.0	0.043	0.093	0.225	0.370	0.600	1.160	2.989
	3.0	0.068	0.146	0.351	0.580	0.920	1.718	4.098
	1.5	0.096	0.205	0.488	0.800	1.250	2.267	5.074
10 dB	8.0	0.070	0.150	0.350	0.580	0.920	1.718	4.098
	5.0	0.140	0.290	0.670	1.090	1.670	2.941	6.160
	3.0	0.210	0.450	1.030	1.620	2.420	4.039	7.754
	1.5	0.300	0.620	1.390	2.140	3.120	5.008	9.036
7 dB	8.0	0.140	0.290	0.670	1.090	1.670	2.941	6.160
	5.0	0.270	0.560	1.260	1.950	2.870	4.672	8.601
	3.0	0.410	0.850	1.850	2.790	3.950	6.088	10.374
	1.5	0.570	1.160	2.430	3.560	4.910	7.264	11.756

Third Order Two Tone Intercept

$$IP^3 = \frac{\text{Supression}}{2} + \text{Input Level}$$

Example A

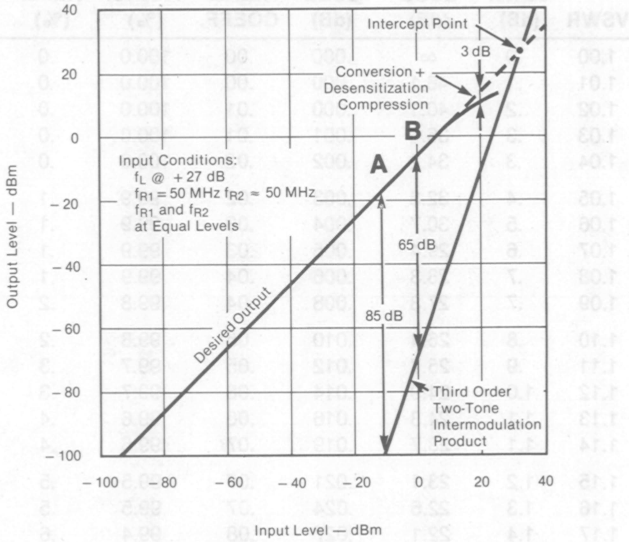
$$IP^3 = \frac{85\text{ dB}}{2} + (-10) = 32.5\text{ dB}$$

Example B

$$IP^3 = \frac{65\text{ dB}}{2} + (-0) = 32.5\text{ dB}$$

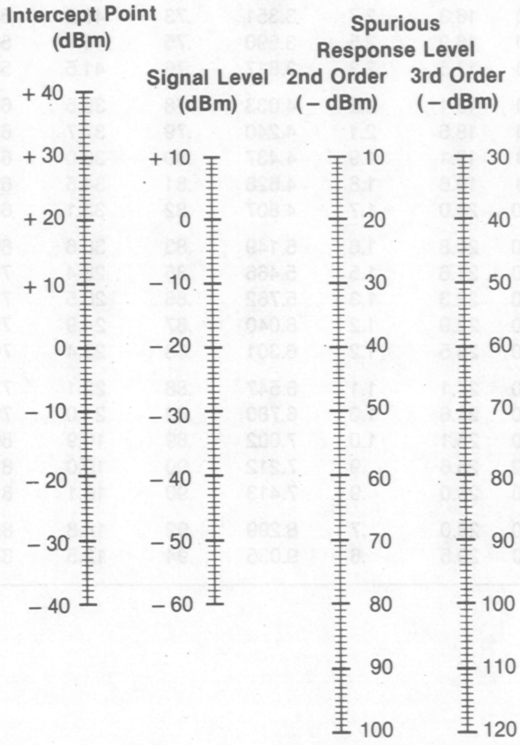
Problem: Predict How Far Down Spurs Will Be With Two −30 dBm Inputs.

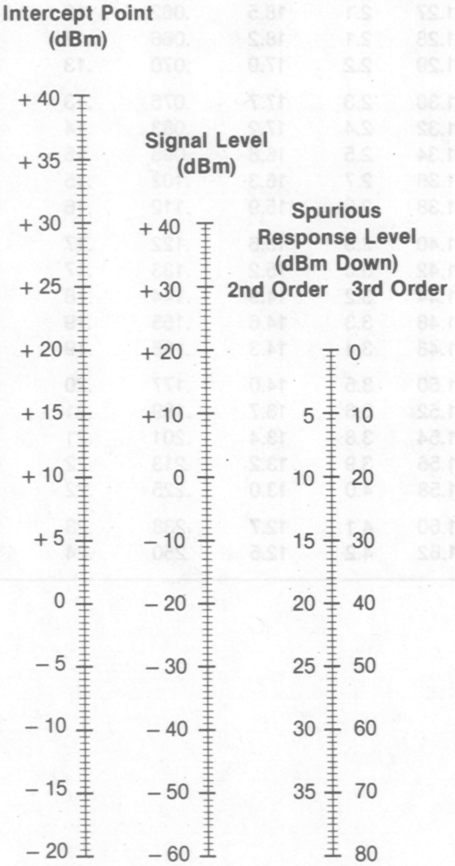
Suppression = 2 (IP − Input Level)
= 2 (32.5 − (−30)) = 2 (62.5)
= 125 dB Down



AVANTEK DYNAMIC RANGE NOMOGRAPH

(See page 234 for instructions.)


Intercept Point (dBm)
+40
+30
+20
+10
0
−10
−20
−30
−40
Signal Level (dBm)
+10
0
−10
−20
−30
−40
−50
−60
Spurious Response Level
2nd Order (−dBm)
10
20
30
40
50
60
70
80
90
100
3rd Order (−dBm)
30
40
50
60
70
80
90
100
110
120


Intercept Point (dBm)
+40
+35
+30
+25
+20
+15
+10
+5
0
−5
−10
−15
−20
Signal Level (dBm)
+40
+30
+20
+10
0
−10
−20
−30
−40
−50
−60
Spurious Response Level (dBm Down)
2nd Order
0
5
10
15
20
25
30
35
3rd Order
0
10
20
30
40
50
60
70
80

THE EFFECT OF VSWR ON TRANSMITTED POWER

VSWR	VSWR (dB)	RETURN LOSS (dB)	TRANS. LOSS (dB)	VOLT. REFL. COEFF.	POWER TRANS. (%)	POWER REFL. (%)
1.00	.0	∞	.000	.00	100.0	.0
1.01	.1	46.1	.000	.00	100.0	.0
1.02	.2	40.1	.000	.01	100.0	.0
1.03	.3	36.6	.001	.01	100.0	.0
1.04	.3	34.2	.002	.02	100.0	.0
1.05	.4	32.3	.003	.02	99.9	.1
1.06	.5	30.7	.004	.03	99.9	.1
1.07	.6	29.4	.005	.03	99.9	.1
1.08	.7	28.3	.006	.04	99.9	.1
1.09	.7	27.3	.008	.04	99.8	.2
1.10	.8	26.4	.010	.05	99.8	.2
1.11	.9	25.7	.012	.05	99.7	.3
1.12	1.0	24.9	.014	.06	99.7	.3
1.13	1.1	24.3	.016	.06	99.6	.4
1.14	1.1	23.7	.019	.07	99.6	.4
1.15	1.2	23.1	.021	.07	99.5	.5
1.16	1.3	22.6	.024	.07	99.5	.5
1.17	1.4	22.1	.027	.08	99.4	.6
1.18	1.4	21.7	.030	.08	99.3	.7
1.19	1.5	21.2	.033	.09	99.2	.8
1.20	1.6	20.8	.036	.09	99.2	.8
1.21	1.7	20.4	.039	.10	99.1	.9
1.22	1.7	20.1	.043	.10	99.0	1.0
1.23	1.8	19.7	.046	.10	98.9	1.1
1.24	1.9	19.4	.050	.11	98.9	1.1
1.25	1.9	19.1	.054	.11	98.8	1.2
1.26	2.0	18.8	.058	.12	98.7	1.3
1.27	2.1	18.5	.062	.12	98.6	1.4
1.28	2.1	18.2	.066	.12	98.5	1.5
1.29	2.2	17.9	.070	.13	98.4	1.6
1.30	2.3	17.7	.075	.13	98.3	1.7
1.32	2.4	17.2	.083	.14	98.1	1.9
1.34	2.5	16.8	.093	.15	97.9	2.1
1.36	2.7	16.3	.102	.15	97.7	2.3
1.38	2.8	15.9	.112	.16	97.5	2.5
1.40	2.9	15.6	.122	.17	97.2	2.8
1.42	3.0	15.2	.133	.17	97.0	3.0
1.44	3.2	14.9	.144	.18	96.7	3.3
1.46	3.3	14.6	.155	.19	96.5	3.5
1.48	3.4	14.3	.166	.19	96.3	3.7
1.50	3.5	14.0	.177	.20	96.0	4.0
1.52	3.6	13.7	.189	.21	95.7	4.3
1.54	3.8	13.4	.201	.21	95.5	4.5
1.56	3.9	13.2	.213	.22	95.2	4.8
1.58	4.0	13.0	.225	.22	94.9	5.1
1.60	4.1	12.7	.238	.23	94.7	5.3
1.62	4.2	12.5	.250	.24	94.4	5.6
1.64	4.3	12.3	.263	.24	94.1	5.9
1.66	4.4	12.1	.276	.25	93.8	6.2
1.68	4.5	11.9	.289	.25	93.6	6.4
1.70	4.6	11.7	.302	.26	93.3	6.7
1.72	4.7	11.5	.315	.26	93.0	7.0
1.74	4.8	11.4	.329	.27	92.7	7.3
1.76	4.9	11.2	.342	.28	92.4	7.6
1.78	5.0	11.0	.356	.28	92.1	7.9
1.80	5.1	10.9	.370	.29	91.8	8.2
1.82	5.2	10.7	.384	.29	91.5	8.5
1.84	5.3	10.6	.398	.30	91.3	8.7
1.86	5.4	10.4	.412	.30	91.0	9.0
1.88	5.5	10.3	.426	.31	90.7	9.3
1.90	5.6	10.2	.440	.31	90.4	9.6
1.92	5.7	10.0	.454	.32	90.1	9.9
1.94	5.8	9.9	.468	.32	89.8	10.2
1.96	5.8	9.8	.483	.32	89.5	10.5
1.98	5.9	9.7	.497	.33	89.2	10.8
2.00	6.0	9.5	.512	.33	88.9	11.1
2.50	8.0	7.4	.881	.43	81.6	18.4
3.00	9.5	6.0	1.249	.50	75.0	25.0
3.50	10.9	5.1	1.603	.56	69.1	30.9
4.00	12.0	4.4	1.938	.60	64.0	36.0
4.50	13.1	3.9	2.255	.64	59.5	40.5
5.00	14.0	3.5	2.553	.67	55.6	44.4
5.50	14.8	3.2	2.834	.69	52.1	47.9
6.00	15.6	2.9	3.100	.71	49.0	51.0
6.50	16.3	2.7	3.351	.73	46.2	53.8
7.00	16.9	2.5	3.590	.75	43.7	56.2
7.50	17.5	2.3	3.817	.76	41.5	58.5
8.00	18.1	2.2	4.033	.78	39.5	60.5
8.50	18.6	2.1	4.240	.79	37.7	62.3
9.00	19.1	1.9	4.437	.80	36.0	64.0
9.50	19.6	1.8	4.626	.81	34.5	65.5
10.00	20.0	1.7	4.807	.82	33.1	66.9
11.00	20.8	1.6	5.149	.83	30.6	69.4
12.00	21.6	1.5	5.466	.85	28.4	71.6
13.00	22.3	1.3	5.762	.86	26.5	73.5
14.00	22.9	1.2	6.040	.87	24.9	75.1
15.00	23.5	1.2	6.301	.88	23.4	76.6
16.00	24.1	1.1	6.547	.88	22.1	77.9
17.00	24.6	1.0	6.780	.89	21.0	79.0
18.00	25.1	1.0	7.002	.89	19.9	80.1
19.00	25.6	.9	7.212	.90	19.0	81.0
20.00	26.0	.9	7.413	.90	18.1	81.9
25.00	28.0	.7	8.299	.92	14.8	85.2
30.00	29.5	.6	9.035	.94	12.5	87.5

DECIBALS — VOLTS — WATTS CONVERSION TABLE FOR A 50-OHM SYSTEM

dBm	V	P_O	dBm	V	P_O	dBm	mV	P_O	dBm	µV	P_O
+ 53	100.0	200W	0	.225	1.0 mW	– 49	0.80		– 98	2.9	
+ 50	70.7	100W	– 1	.200	.80 mW	– 50	0.71	.01 µW	– 99	2.51	
+ 49	64.0	80W	– 2	.180	.64 mW	– 51	0.64		– 100	2.25	.1 pW
+ 48	58.0	64W	– 3	.160	.50 mW	– 52	0.57		– 101	2.0	
+ 47	50.0	50W	– 4	.141	.40 mW	– 53	0.50		– 102	1.8	
+ 46	44.5	40W	– 5	.125	.32 mW	– 54	0.45		– 103	1.6	
+ 45	40.0	32W	– 6	.115	.25 mW	– 55	0.40		– 104	1.41	
+ 44	32.5	25W	– 7	.100	.20 mW	– 56	0.351		– 105	1.27	
+ 43	32.0	20W	– 8	.090	.16 mW	– 57	0.32		– 106	1.18	
+ 42	28.0	16W	– 9	.080	.125 mW	– 58	0.286				
+ 41	26.2	12.5W	– 10	.071	.10 mW	– 59	0.251		**dBm**	**nV**	
+ 40	22.5	10W	– 11	.064		– 60	0.225	.001 µW	– 107	1000	
+ 39	20.0	8W	– 12	.058		– 61	0.200		– 108	900	
+ 38	18.0	6.4W	– 13	.050		– 62	0.180		– 109	800	
+ 37	16.0	5W	– 14	.045		– 63	0.160		– 110	710	.01 pW
+ 36	14.1	4W	– 15	.040		– 64	0.141		– 111	640	
+ 35	12.5	3.2W	– 16	.0355					– 112	580	
+ 34	11.5	2.5W				**dBm**	**µV**		– 113	500	
+ 33	10.0	2W	**dBm**	**mV**		– 65	128		– 114	450	
+ 32	9.0	1.6W	– 17	31.5		– 66	115		– 115	400	
+ 31	8.0	1.25W	– 18	28.5		– 67	100		– 116	355	
+ 30	7.10	1.0W	– 19	25.1		– 68	90		– 117	825	
+ 29	6.40	800 mW	– 20	22.5	.01 mW	– 69	80		– 118	285	
+ 28	5.80	640 mW	– 21	20.0		– 70	71	.1 nW	– 119	251	
+ 27	5.00	500 mW	– 22	17.9		– 71	65		– 120	225	.001 pW
+ 26	4.45	400 mW	– 23	15.9		– 72	58		– 121	200	
+ 25	4.00	320 mW	– 24	14.1		– 73	50		– 122	180	
+ 24	3.55	250 mW	– 25	12.8		– 74	45		– 123	160	
+ 23	3.20	200 mW	– 26	11.5		– 75	40		– 124	141	
+ 22	2.80	160 mW	– 27	10.0		– 76	35		– 125	128	
+ 21	2.52	125 mW	– 28	8.9		– 77	32		– 126	117	
+ 20	2.25	100 mW	– 29	8.0		– 78	29		– 127	100	
+ 19	2.00	80 mW	– 30	7.1	.001 mW	– 79	25		– 128	90	
+ 18	1.80	64 mW	– 31	6.25		– 80	22.5	.01 nW	– 129	80	
+ 17	1.60	50 mW	– 32	5.8		– 81	20.0		– 130	71	.1 fW
+ 16	1.41	40 mW	– 33	5.0		– 82	18.0		– 131	61	
+ 15	1.25	32 mW	– 34	4.5		– 83	16.0		– 132	58	
+ 14	1.15	25 mW	– 35	4.0		– 84	11.1		– 133	50	
+ 13	1.00	20 mW	– 36	3.5		– 85	12.9		– 134	45	
+ 12	.90	16 mW	– 37	3.2		– 86	11.5		– 135	40	
+ 11	.80	12.5 mW	– 38	2.85		– 87	10.0		– 136	35	
+ 10	.71	10 mW	– 39	2.5		– 88	9.0		– 137	33	
+ 9	.64	8 mW	– 40	2.25	.1 µW	– 89	8.0		– 138	29	
+ 8	.58	6.4 mW	– 41	2.0		– 90	7.1	.001 nW	– 139	25	
+ 7	.500	5 mW	– 42	1.8		– 91	6.1		– 140	23	.01 fW
+ 6	.445	4 mW	– 43	1.6		– 92	5.75				
+ 5	.400	3.2 mW	– 44	1.4		– 93	5.0				
+ 4	.355	2.5 mW	– 45	1.25		– 94	4.5				
+ 3	.320	2.0 mW	– 46	1.18		– 95	4.0				
+ 2	.280	1.6 mW	– 47	1.00		– 96	3.51				
+ 1	.252	1.25 mW	– 48	0.90		– 97	3.2				

Quality Assurance, Warranty and Ordering Information

Avantek Quality Assurance

Avantek's Quality Assurance department operates independently of both engineering and manufacturing. Its purpose is to assure that all Avantek products as well as equipment and systems meet the rigid quality standards that Avantek is known for. Both Avantek product reliability policies and workmanship standards are continually revised to keep pace with new and improved manufacturing processes as they are instituted.

Responsibilities of the Quality Assurance Department include:

- Maintaining an effective, efficient system of quality assurance and control which meets the MIL-Q-9858A.
- Maintaining an effective liaison with our customer's quality control and source inspection personnel.
- Establishing and maintaining corporate-wide product and workmanship standards, and process specifications.
- Exercising an audit function on production processes to maintain the performance and reliability designed into every Avantek product.
- Assuring that all supplies and services procured from vendors conform to Avantek engineering and quality standards.

How To Order

Avantek modular products may be ordered through any of our distributors and representatives or they may be ordered from Avantek Component Sales directly for immediate shipment.

Warranties, Standard Terms and Conditions

Our confidence in all Avantek products' reliability and performance is such that all of our oscillator and filter products carry the following warranties:

1. **General Warranty**
   Seller warrants each item manufactured by it to be free from defects in material and workmanship. In no event will the seller be liable for consequential or resulting loss or damage, whether or not due to causes covered by these warranties. (See specific product warranty below for details of warranty period and other conditions.)
2. **Specific Product Warranty**
   All Avantek products are manufactured to high quality standards and are warranted against defects in workmanship, materials and construction and to no further extent. In no event will Avantek be liable for consequential misuse or damages. Avantek products are warranted against any above-named defects which appear within one (1) year of shipping date, and will be replaced or repaired at Avantek's discretion after engineering review of the complaint, providing the procedure outlined below is followed. This warranty is the only warranty made by the supplier and is in lieu of all other warranties, expressed or implied, except as to title, and can be amended only by a written instrument signed by an officer of Avantek. Avantek field offices or agents are not authorized to make commitments on warranty returns, but can provide liaison.

   In the event that it is necessary to return products against the above warranty, the following procedure is to be followed:

   A. Return authorizations are to be requested prior to return, stating model number, serial number and requested action.
      1) Units are then forwarded to Avantek, transportation prepaid.
      2) Units returned freight collect or without authorization will not be accepted.

      Such requests should be directed to Avantek Modular Components Customer Service (408) 943-4497.

   B. Original product identification markings must not be removed, defaced, or altered, and the product must not have been subjected to abuse, improper installation or application, alteration, accident or negligence in use, storage, transportation or handling.

   C. Return units will undergo complete test and evaluation. Replacements and/or repair will be determined only after Avantek has determined the cause of failure. All units returned are subject to a standard evaluation charge when:
      1) The units meet full specifications and do not require repair, or,
      2) After evaluation, non-warranty repairs are not authorized by the customer.

   D. Avantek is not responsible for failures due to excessive stresses caused by rough handling during test or installation at the user's location; nor can Avantek be responsible for damage caused by improper operation or faulty power supplies. Factory return inspection techniques can usually sort out latent defects from excessive voltages and currents with respect to credit or non-credit.

Every precaution is used at the factory to insure that every unit meets all electrical and mechanical specifications prior to shipment. Customers are asked to advise their incoming inspection and test personnel as to the precautions required in testing low power microwave components.

For any assistance, contact your nearest Avantek sales office, representative or Avantek, Inc., 3175 Bowers Avenue, Santa Clara, CA 95051. Telephone (408) 727-0700. TWX 310-371-8717.

3. Limitations of Liabilities

Avantek's liability on any claim of any kind, including negligence, for any loss or damage arising from, connected with, or resulting from this contract (or quotation), or from the performance or breach thereof, or from the design, manufacture, sale, delivery, installation, inspection, operation or use of any equipment covered by or furnished under this contract, shall in no case exceed the purchase price of the unit (or equipment) which gives rise to the claim.

In no event, whether as a result of breach of contract or warranty or alleged negligence, shall Avantek be liable for special or consequential damages including but not limited to, loss of profits or revenue, loss of use to the equipment or an associated equipment, cost of capital, cost of substitute equipment, facilities or services, down-time costs, or claims of customers of the buyer for such damages.

4. Delivery

Unless otherwise specifically provided, delivery of the equipment shall be made F.O.B. point of shipment, at which time the title and risk of loss shall pass to the purchaser. Avantek shall in no way responsible for the safe arrival of the shipment. Title shall also pass to buyer regardless of any provisions for payment of freight or insurance by Avantek. Avantek shall not be liable for delays in delivery or in performance, or failure to manufacture due to causes beyond its reasonable control.

5. Terms of Payment

A. Unless otherwise specifically provided, price is payable upon shipment to buyer. Alternate terms of payment are subject to approval of Avantek.

B. If shipments are delayed by buyer, payments shall become due and payable on the date when Avantek is prepared to make shipment.

C. Equipment, held for the buyer beyond a reasonable period, shall be at the risk of the buyer and subject to warehouse charges.

D. If the financial condition of the buyer at any time does not, in Avantek's judgement, justify continuance of the work to be performed by Avantek, Avantek may require full or partial payment in advance, on a C.O.D. basis, or shall be entitled to cancel any order then outstanding and shall receive full recovery costs. If the buyer undergoes insolvency or bankruptcy, Avantek shall be entitled to cancel any outstanding order, and shall be entitled to receive reasonable reimbursement for cancellation, or work performed up to that time, providing claims are filed during the period allowed.

6. Sales or Similar Taxes

Unless otherwise stated, Avantek's prices do not include sales, use or similar taxes.

7. Cancellation

A. The buyer may cancel an order only upon written notice sixty (60) days prior to shipment, and upon payment to Avantek of any reasonable cancellation charges.

B. Orders which are cancelled prior to shipment, if standard items, are subject to a 15% restocking charge for those items already in production or in finished goods inventory awaiting shipment to buyer.

C. Orders which are cancelled prior to shipment, if those items are "special" or "custom" items designed or modified to the buyer's specifications, are essentially non-cancellable for that portion in production or in finished goods inventory awaiting shipment to the buyer, and are subject to full recovery costs.

D. Orders which are cancelled after shipment to buyer, whether standard or special, remain the property of that buyer.

8. Price Changes

Avantek reserves the right to revise and announce new prices for the products covered in this catalog. Avantek will honor the old prices if an order is received prior to revision of those prices, or prior to the expiration of a valid quotation outstanding at the time of the price change. Subsequent orders for the same equipment are subject to the revised or newly-announced prices.

9. Substitutions

Avantek reserves the right to modify the design and specifications of its products, provided that the modifications do not adversely affect the performance of such product or do not reduce the performance below contract specifications.

10. General Conditions

A. No understanding, promise, or representation and no waiver, alteration or modification of any of the provisions stated, shall be binding upon Avantek unless accepted in writing by an authorized employee of Avantek.

B. Quoted prices do not include rights to technical data nor to they include proprietary rights, company private or competitively sensitive data, unless expressly quoted as a separate item in each instance.*

11. Minimum Orders

Avantek reserves the right to invoke a minimum charge of $100 per domestic order ($200 per international order) requiring export license or documentation.

*ancillary clauses or interpretation of any unrelated provision for assession of data rights shall be void.

Avantek Worldwide Sales Offices

Regional Sales Offices

EASTERN
Avantek, Inc.
10005 Old Columbia Road, Suite N165
Columbia, MD 21046
(301) 381-2600

CENTRAL
Avantek, Inc.
Woodcreek Plaza, Suite 180
101 W. Renner Road
Richardson, TX 75080
(214) 437-5694

WESTERN
Avantek, Inc.
200 N. Westlake Blvd., Suite 100
Westlake Village, CA 91362
(805) 373-3870

Direct Sales Offices

MASSACHUSETTS
Avantek, Inc.
Court House Lane IV, Unit 11
Chelmsford, MA 01824
(617) 453-8846

NEW YORK
Avantek, Inc.
6800 Jericho Turnpike
North Shore Atrium, Suite 118E
Syosset, NY 11791
(516) 496-4500

GEORGIA
Executive Square, Suite Q
4291 Memorial Drive
Decatur, GA 30032
(404) 498-2151

MISSOURI
11 Homestead Lane
Villa Ridge, MO 63089
(314) 948-6658

COLORADO
Avantek, Inc.
14261 E. 4th Ave., Suite 39
Aurora, CO 80011
(303) 367-1000

ILLINOIS
Avantek, Inc.
Countryside Executive Center
Suite 503
1250 N. Northwest Hwy.
Palatine, IL 60067
(312) 358-8963

CALIFORNIA
Avantek, Inc.
1820 W. Orangewood Ave.
Bldg. D, Suite 108
Orange, CA 92669
(714) 978-8076

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OREGON, WASHINGTON, IDAHO
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Foothill Office Center
105 Fremont Avenue
Los Altos, CA 94022
(415) 948-6533

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11701 Mississippi Avenue
Los Angles, CA 90025
(213) 477-9054

Cain Technology
1046 N. Tustin, Suite 1
Orange, CA 92667
(714) 997-7311

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Applied Engineering Consultants
10101-G Bacon Drive
Beltsville, MD 20705
(301) 595-5393 (Metro DC)
(301) 792-2211 (Maryland)
(800) 638-8555 (All other)

MICHIGAN
Comtel Instruments
21223 Hilltop Street
Southfield, MI 48037
(313) 358-2505

MINNESOTA, NORTH AND SOUTH DAKOTA,
IOWA (NORTHERN), WISCONSIN (Except
SOUTHEASTERN)
Electronic Sales Agencies, Inc.
8053 Bloomington Freeway
Bloomington, MN 55420
(612) 884-8291

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R.J. Sickles Associates
175 Bedford Street, Suite 12
Lexington, MA 02173
(617) 862-5100

NEW JERSEY (NORTHERN)
NEW YORK (METROPOLITAN)
Technical Marketing Associates
180 North Street
Teterboro, NJ 07608
(201) 342-4008

NEW YORK (UPPER STATE)
Robtron
53½ Jordan Street
Skaneateles, NY 13152
(315) 685-5731

OHIO (NORTHERN)
Comtel Instruments
5387 Avion Park Drive
Cleveland, OH 44143
(216) 442-8080

OHIO (SOUTHWESTERN)
Comtel Instruments
1717 Big Hill Road, Suite 6A
Dayton, OH 45429
(513) 298-7573

OHIO (SOUTHEASTERN)
Comtel Instruments
5006 Cemetary Road
Hilliard, OH 43026
(614) 876-8305

PENNSYLVANIA (WESTERN)
Comtel Instruments
#9 Parkway Center, Suite 180
Pittsburgh, PA 15220
(412) 922-5720

TEXAS (NORTHEASTERN), OKLAHOMA,
ARKANSAS, LOUISIANA (NORTHERN)
Thorson Southwest
4445 Alpha Road
Dallas, TX 75234
(214) 233-5744

TEXAS (SOUTHWESTERN)
Thorson Southwest
8920 Business Park Drive, Suite 170
Austin, TX 78759
(512) 345-1985

TEXAS (SOUTHEASTERN)
LOUISIANA (SOUTHERN)
Thorson Sourthwest
6633 Hillcroft, Suite 105
Houston, TX 77081
(713) 771-3504

CANADA
Sheppard Agencies Ltd.
P.O. Box 8
Georgetown, Ontario L7G 4T1, Canada
(416) 877-9846

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Normanhurst,
New South Wales 2076
Australia
Phone: (02) 483508

Graphic Electronic Industries Pty. Ltd.
P.O. Box 147
20 Fullarton Road
Norwood, So. Australia 5067
Phone: (08) 42 6655

BELGIUM
Simac Electronics S.P.RPL
Rue du Progres, 52 Boite 2
1000 Brussels, Belgium
Phone: (32)-2-2192453

FRANCE
Serrgop
4, rue Paul Bert
92150 Suresnes, France
Phone: (33)-1-45-063-303

HONG KONG
Enrich Trading Company
240, 7 Seas Shopping Centre
121 Kings Road
North Point, Hong Kong
Phone: 852-5-663-062 or
852-5-663-087

INDIA
Hinditron Services Pvt. Ltd.
69-A.L. Jagmohandas Marg
Bombay 400 006, India
Phone: 8221529 or 8229677

INDONESIA
P.T. Subur Sakti Putera
J1 Cideng Timur 68A, P.O. Box 4467 Jkt.
Jakarta Pusat, Indonesia
Phone: (62) 359153 or (62) 359764

ISRAEL
M.T.I. Engineering Ltd.
182 Ben Yehuda Street
P.O. Box 16349
Tel-Aviv 61162, Israel
Phone: (972)-3-249-273

ITALY
Sistrel Elettronica Micro-Onde S.P.A.
Via Luigi Chiarelli N. 19
00137 Rome, Italy
Phone: (39)-6-827-8851

JAPAN
Sogo Electronics, Inc.
3-13-15 Minami Karasuyama
Setagaya-KU
Tokyo, 157 Japan
Phone: (81)-3-309-5442

THE NETHERLANDS
Simac Electronics B.V.
Veenstraat 20
5503 HR Veldhoven
The Netherlands
Phone: (31)-40-582911

PHILIPPINES
"Y" Engineering Corporation
2212 Marconi Street
P.O. Box 3355
Makati, Metro Manila
Philippine Islands
Phone: (63)-89-51-28

REPUBLIC OF SOUTH AFRICA
South Continental Devices (Pty.) Ltd.
P.O. Box 56420 Pinegowrie, 2123
Republic of South Africa

5th Floor Randover House
Dover Street
Randburg, Republic of South Africa
Phone: (28)-11-789-2400

SWEDEN, NORWAY
FINLAND, DENMARK
Visitron AB
P.O. Box 6063
Korssgatan 40
S-16206 Vaellingby, Sweden
Phone: (46)-8-38-01-30

SWITZERLAND
Walter Electronics AG
Bruehlwiesenstrasse 17
CH-9545 Waengi
Switzerland
Phone: (41)-54-512-277

TAIWAN
Evergo Corporation
4th Floor, 75, Section 3
Nan King East Road
Taipei 104, Taiwan
Phone: (886)-2-536-7451

THAILAND
G Simon Radio Co., Ltd.
30 Patpong Avenue
Bangkok, Thailand
Phone: (6)-2-340-9913

UNITED KINGDOM
Wave Devices
Laser House
132/140 Goswell Road
London EC1V 7LE
England
Phone (44)-1-251-5181

WEST GERMANY-AUSTRIA
Focus Electronic GmbH
Nimrodstr, 1 Bergstetten
8851 Kaisheim, West Germany
Phone: (49)-9-09009/591

YUGOSLAVIA
Belram S.A.
83 Avenue des Mimosas
1150 Brussels, Belgium
Phone: (32)-2-343-332

*For areas not covered, contact your nearest Avantek Sales Office listed above.

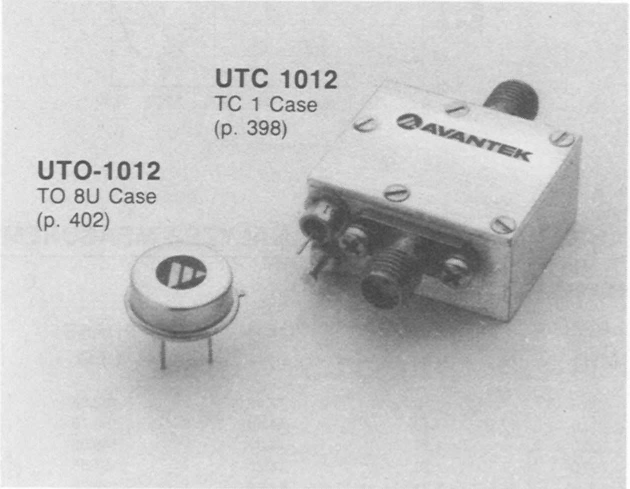
1012 Series

Thin Film Cascadable Amplifier
5-1000 MHz

AVANTEK

FEATURES

- **Low Noise Figure: 3.0 dB**



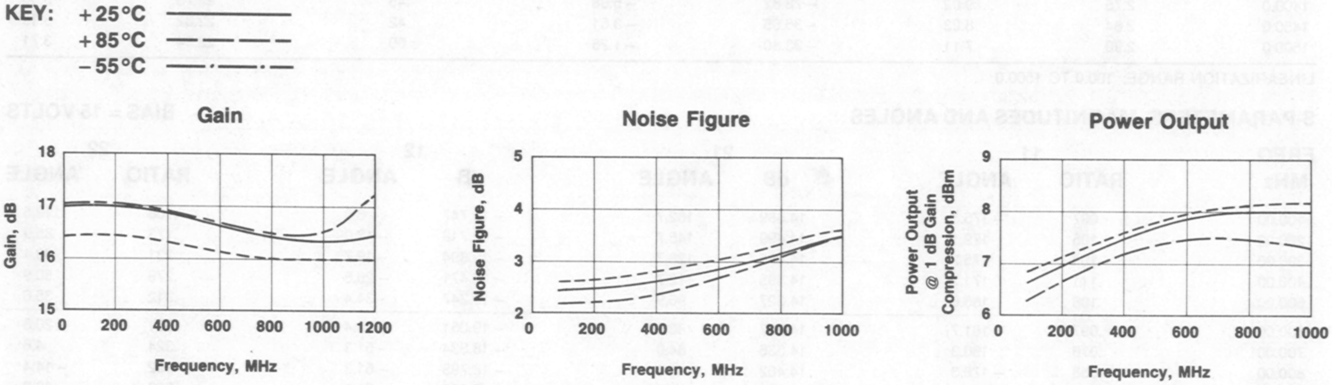
UTC 1012
TC 1 Case
(p. 398)

UTO-1012
TO 8U Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	16.5	15.0 Min.	14.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	3.0	4.0 Max.	4.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+7.0	+4.0 Min.	+3.0 Min.	dBm
—	Input VSWR	<1.8:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+17.0	—	—	dBm
I_D	DC Current	18	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)



MAXIMUM RATINGS

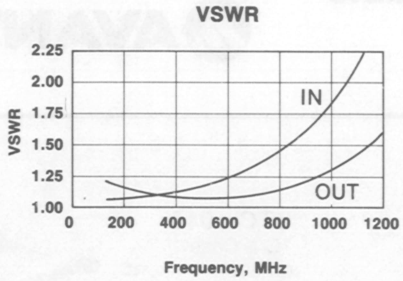
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	120°C/W
Active Transistor Power Dissipation	120 mW
Junction Temperature Above Case Temperature	14.4°C
MTBF	953,751 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.13	17.03	167.43	–.46	.00	1.20	22.33
150.0	1.13	17.09	161.48	–.77	.31	1.18	22.45
200.0	1.13	17.07	156.10	–.50	.30	1.18	22.27
250.0	1.14	16.96	150.74	–.21	.30	1.17	22.48
300.0	1.15	16.92	145.33	.01	.30	1.16	22.71
350.0	1.16	16.85	140.01	.34	.30	1.15	22.83
400.0	1.18	16.77	134.47	.44	.31	1.14	22.80
450.0	1.18	16.65	128.96	.57	.32	1.13	22.90
500.0	1.21	16.56	122.97	.22	.31	1.11	22.98
550.0	1.23	16.46	117.72	.61	.31	1.11	23.28
600.0	1.25	16.40	111.81	.36	.34	1.11	23.64
650.0	1.28	16.43	105.60	–.20	.32	1.11	23.65
700.0	1.31	16.47	100.30	.12	.30	1.13	23.99
750.0	1.36	16.46	94.95	.42	.30	1.15	24.23
800.0	1.41	16.43	89.51	.62	.31	1.18	24.53
850.0	1.48	16.44	83.70	.44	.32	1.22	24.86
900.0	1.56	16.46	77.85	.24	.34	1.26	25.12
950.0	1.66	16.48	71.46	–.50	.37	1.31	25.58
1000.0	1.80	16.56	64.54	–1.79	.39	1.37	26.02
1100.0	2.21	16.66	49.98	—	.45	1.53	27.19
1200.0	2.86	16.58	32.77	—	.45	1.75	29.35
1300.0	3.76	15.87	15.05	—	.54	2.02	31.86
1400.0	4.67	14.55	–3.57	—	.50	2.33	34.08
1500.0	5.17	12.72	–19.84	—	.37	2.51	32.48

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.026	–12.0	17.090	167.5	–22.180	–6.5	.092	170.5
150.00	.044	–32.5	17.084	162.0	–22.099	–5.8	.084	167.5
200.00	.053	–40.0	17.019	155.9	–22.274	–6.5	.084	163.5
250.00	.056	–45.1	16.964	149.8	–22.317	–10.2	.076	160.0
300.00	.063	–46.5	16.966	144.1	–22.559	–13.1	.074	156.3
350.00	.073	–49.2	16.942	138.5	–22.669	–14.3	.071	156.6
400.00	.083	–51.1	16.905	133.2	–22.774	–16.8	.066	156.4
450.00	.094	–52.9	16.796	127.8	–22.946	–20.0	.063	155.7
500.00	.106	–55.4	16.727	122.4	–23.142	–21.5	.059	161.0
550.00	.116	–57.0	16.677	117.0	–23.342	–23.5	.058	165.8
600.00	.128	–59.8	16.629	111.6	–23.378	–27.1	.056	175.4
650.00	.142	–61.9	16.580	106.2	–23.704	–28.8	.056	–175.4
700.00	.158	–64.5	16.568	100.8	–23.711	–31.0	.062	–167.8
750.00	.173	–67.2	16.551	95.2	–24.059	–33.2	.072	–160.4
800.00	.192	–71.0	16.516	89.4	–24.432	–35.6	.084	–153.9
850.00	.211	–75.9	16.532	83.3	–24.883	–38.3	.100	–150.7
900.00	.237	–80.5	16.560	77.4	–24.993	–40.4	.118	–149.5
950.00	.263	–86.0	16.573	70.9	–25.518	–41.7	.138	–149.5
1000.00	.295	–92.2	16.595	64.1	–25.979	–44.5	.160	–150.5
1100.00	.379	–107.1	16.633	49.1	–27.098	–49.3	.212	–154.6
1200.00	.479	–124.6	16.531	32.3	–29.122	–50.7	.277	–161.5
1300.00	.572	–144.6	15.908	13.6	–31.710	–44.2	.343	–172.6
1400.00	.642	–165.5	14.638	–3.7	–33.189	–26.2	.398	174.3
1500.00	.674	176.0	12.896	–17.6	–32.245	–5.5	.432	160.8

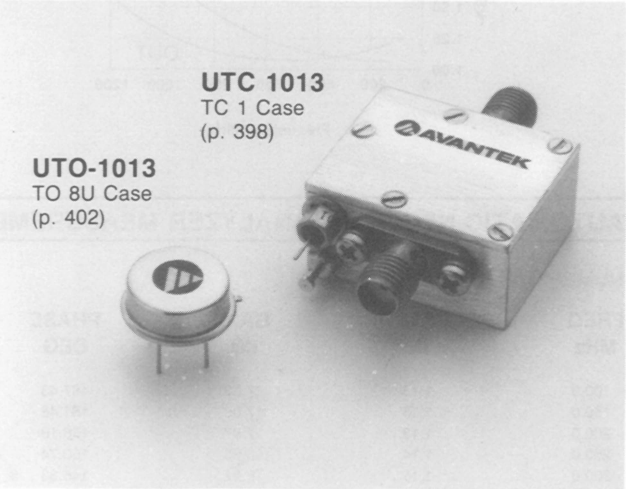
1013 Series

Thin Film Cascadable Amplifier 5-1000 MHz

AVANTEK

FEATURES

- **Medium Output Power: +10.5 dBm**



UTC 1013
TC 1 Case
(p. 398)

UTO-1013
TO 8U Case
(p. 402)

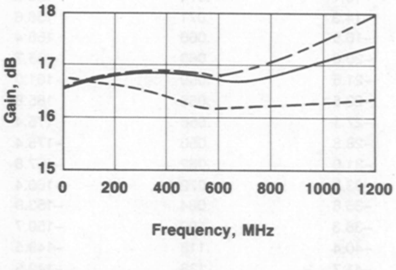
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	16.5	15.0 Min.	14.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	3.0	4.5 Max.	5.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+10.5	+9.0 Min.	+8.0 Min.	dBm
—	Input VSWR	<1.3:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.4:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+20.0	—	—	dBm
I_D	DC Current	29	—	—	mA

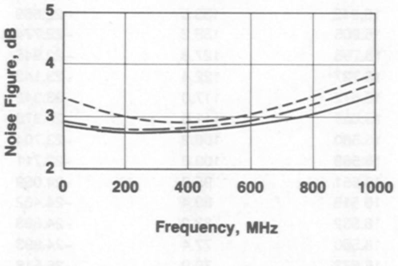
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —— · ——

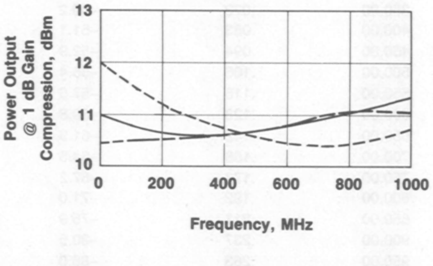
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

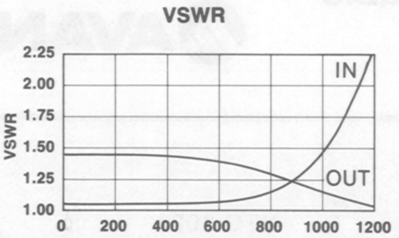
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 120°C/W
Active Transistor Power Dissipation .... 200 mW
Junction Temperature Above Case Temperature .... 24°C
MTBF .... 813,076 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.15	16.80	168.54	–1.03	.00	1.44	21.69
150.0	1.13	16.90	163.11	–1.16	.29	1.42	21.87
200.0	1.14	16.91	158.23	–.71	.27	1.42	21.85
250.0	1.13	16.83	153.30	–.33	.27	1.42	22.16
300.0	1.13	16.80	148.47	.16	.27	1.41	22.29
350.0	1.13	16.78	143.57	.59	.28	1.41	22.21
400.0	1.12	16.72	138.41	.73	.29	1.41	22.35
450.0	1.12	16.67	133.32	.96	.30	1.40	22.35
500.0	1.11	16.58	127.63	.59	.29	1.39	22.42
550.0	1.12	16.54	122.75	1.03	.29	1.37	22.54
600.0	1.11	16.53	117.05	.66	.33	1.36	22.86
650.0	1.11	16.58	111.04	–.01	.31	1.35	22.89
700.0	1.12	16.70	105.89	.15	.28	1.33	22.91
750.0	1.13	16.74	100.81	.40	.29	1.31	23.27
800.0	1.16	16.74	95.61	.52	.30	1.28	23.31
850.0	1.19	16.80	90.00	.23	.31	1.24	23.54
900.0	1.24	16.86	84.48	.02	.32	1.21	23.63
950.0	1.31	16.93	78.37	–.77	.35	1.17	23.97
1000.0	1.40	16.99	71.78	–2.04	.38	1.12	24.10
1100.0	1.69	17.16	57.57	—	.43	1.06	24.93
1200.0	2.17	17.19	41.05	—	.45	1.19	26.56
1300.0	2.90	16.56	24.54	—	.51	1.43	29.10
1400.0	3.82	15.39	6.14	—	.48	1.73	32.43
1500.0	4.75	13.80	–9.81	—	.38	2.01	31.88

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.101	177.4	16.864	168.8	–22.054	–4.4	.179	169.6
150.00	.092	–178.6	16.885	163.7	–21.943	–4.4	.173	163.5
200.00	.090	–177.3	16.824	158.1	–21.843	–4.8	.176	156.6
250.00	.088	–176.5	16.792	152.6	–22.033	–8.0	.171	151.0
300.00	.084	–177.1	16.834	147.3	–22.121	–9.8	.172	145.4
350.00	.079	–175.3	16.838	142.1	–22.414	–10.8	.171	140.9
400.00	.073	–174.1	16.848	137.2	–22.395	–13.2	.170	135.4
450.00	.067	–170.9	16.789	132.2	–22.276	–15.3	.169	130.8
500.00	.062	–166.8	16.764	127.3	–22.535	–16.7	.167	126.8
550.00	.057	–165.4	16.768	122.3	–22.590	–18.2	.165	122.7
600.00	.054	–157.7	16.748	117.3	–22.645	–20.8	.158	117.8
650.00	.052	–147.8	16.755	112.2	–22.792	–22.6	.153	112.7
700.00	.054	–138.4	16.795	107.1	–22.784	–24.8	.147	108.5
750.00	.057	–128.4	16.829	101.8	–22.980	–26.8	.139	–103.8
800.00	.067	–119.3	16.847	96.4	–23.214	–28.0	.127	98.7
850.00	.082	–115.3	16.902	90.4	–23.532	–30.3	.115	93.6
900.00	.103	–113.0	16.989	84.8	–23.644	–33.2	.100	87.3
950.00	.128	–114.9	17.051	78.6	–23.893	–34.3	.083	80.2
1000.00	.159	–117.3	17.102	71.9	–24.072	–36.4	.064	70.0
1100.00	.246	–127.5	17.216	57.5	–24.932	–41.6	.024	–7.4
1200.00	.356	–143.0	17.186	41.5	–26.478	–46.6	.081	–97.3
1300.00	.478	–161.6	16.709	23.4	–28.700	–46.8	.173	–125.6
1400.00	.586	178.7	15.624	6.0	–31.741	–31.8	.265	–148.0
1500.00	.654	160.2	14.076	–7.7	–31.789	–1.7	.335	–187.4

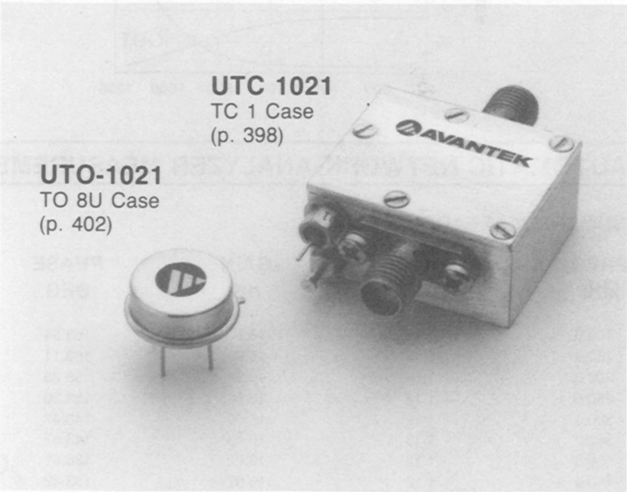
1021 Series

Thin Film Cascadable Amplifier 5-1000 MHz

AVANTEK

FEATURES

- **High Gain: 24.0 dB**
- **Medium Output Power: +13.0 dBm**

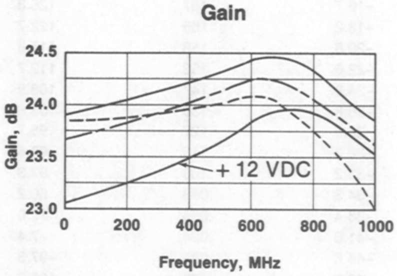


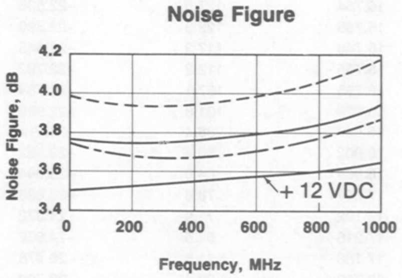
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

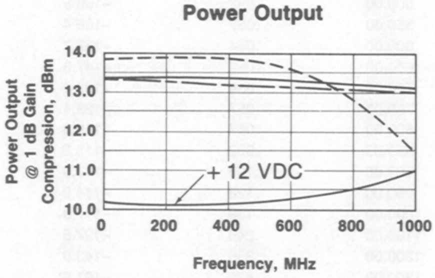
Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	24.0	22.0 Min.	21.0 Min.	dB
—	Gain Flatness	±0.7	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	3.8	4.5 Max.	5.0 Max.	dB
$P_{1\ dB}$	Power Output @ + 1 dB Compression	+13.0	+12.0 Min.	+11.0 Min.	dBm
—	Input VSWR	<1.6:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.6:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+27.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+44.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+50.0	—	—	dBm
I_D	DC Current	85	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—







MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +100°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+100°C

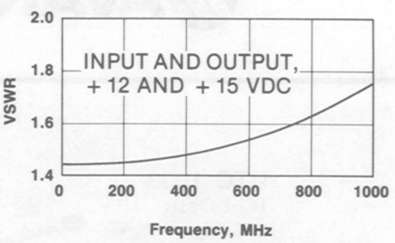
THERMAL CHARACTERISTICS*

θ_{JC}	120/110°C/W
Active Transistor Power Dissipation	230/460 mW
Junction Temperature Above Case Temperature	28/50°C
MTBF	474,271 Hrs.

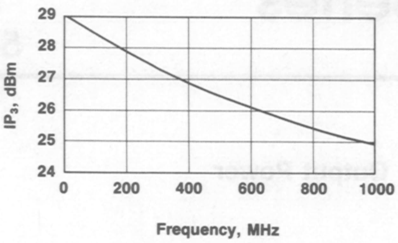
*For further information, see High Reliability section.

WEIGHT: UTO — 2.1 grams (typical); UTC — 21.5 grams

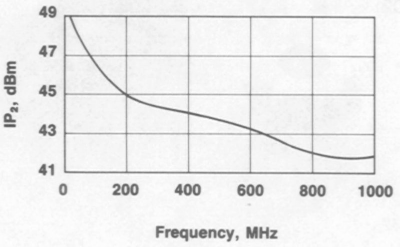
VSWR



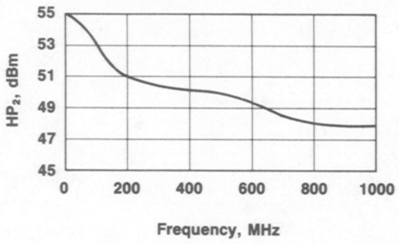
Third-Order Intercept Point



Second-Order Intercept Point



Second-Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.23	23.92	–19.76	–1.86	.00	1.46	39.57
200.0	1.29	23.86	–38.37	-.30	.53	1.47	38.06
300.0	1.32	23.81	–58.28	-.05	.55	1.50	38.34
400.0	1.33	23.86	–77.78	.60	.56	1.53	38.86
500.0	1.33	24.06	–97.55	.99	.53	1.57	39.30
600.0	1.33	24.08	–117.37	1.32	.56	1.62	40.29
700.0	1.37	24.08	–137.82	1.02	.58	1.69	41.20
800.0	1.46	23.88	–158.85	.17	.59	1.75	42.65
900.0	1.60	23.79	179.93	-.87	.57	1.80	44.65
1000.0	1.75	23.77	158.44	–2.20	.60	1.80	46.55
1100.0	1.92	23.89	137.08	—	.63	1.74	47.79
1200.0	2.05	23.50	113.77	—	.67	1.57	45.26
1300.0	1.94	22.61	89.77	—	.61	1.41	44.27
1400.0	1.81	21.46	68.99	—	.55	1.32	43.97
1500.0	1.75	20.55	50.19	—	.52	1.29	45.01

LINEARIZATION RANGE: 100.0 TO 1000.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.185	146.0	23.784	– 18.6	– 38.957	6.3	.127	171.9
200.00	.196	121.9	23.853	– 36.4	– 38.320	– 7.7	.130	172.8
300.00	.208	101.8	23.911	– 55.6	– 38.914	– 13.9	.144	166.8
400.00	.217	82.3	24.117	– 74.8	– 38.946	– 21.9	.157	156.7
500.00	.214	60.7	24.500	– 94.9	– 39.187	– 30.0	.174	142.7
600.00	.204	33.0	24.667	– 115.4	– 40.060	– 39.4	.194	126.6
700.00	.203	– 1.5	24.741	– 137.0	– 41.302	– 46.9	.214	110.3
800.00	.218	– 37.0	24.566	– 159.8	– 43.007	– 53.4	.235	94.0
900.00	.249	– 67.7	24.335	177.3	– 44.784	– 54.5	.249	79.7
1000.00	.277	– 93.1	24.053	154.6	– 47.587	– 41.4	.248	65.2
1100.00	.297	– 116.5	23.828	132.8	– 47.857	– 23.1	.227	48.2
1200.00	.299	– 143.5	23.064	109.9	– 44.830	– 21.8	.181	31.5
1300.00	.255	– 172.2	21.912	87.4	– 43.135	– 30.0	.137	18.9
1400.00	.204	158.6	20.568	68.2	– 42.697	– 40.6	.110	6.5
1500.00	.169	127.2	19.516	50.7	– 42.957	– 43.3	.108	– 9.7

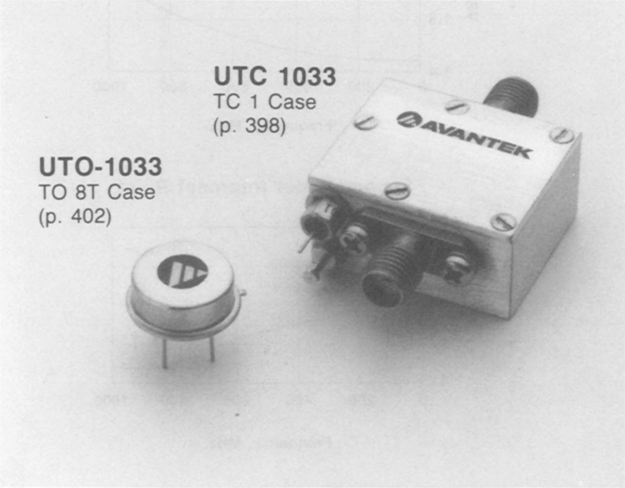
1033 Series

Thin Film Cascadable Amplifier 5-1000 MHz

AVANTEK

FEATURES

- **+16.0 dBm Output Power**



UTC 1033
TC 1 Case
(p. 398)

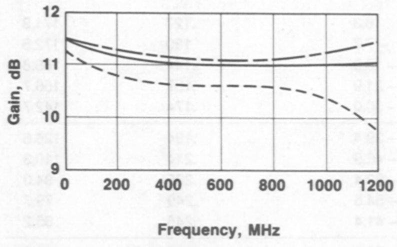
UTO-1033
TO 8T Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

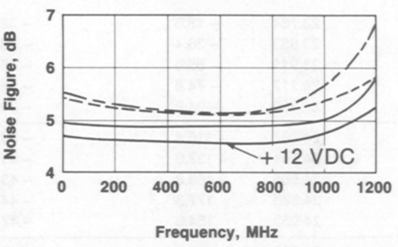
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	11.0	10.0 Min.	9.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	5.5	6.5 Max.	7.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+16.0	+14.0 Min.	+13.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+28.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+40.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+46.0	—	—	dBm
I_D	DC Current	48	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

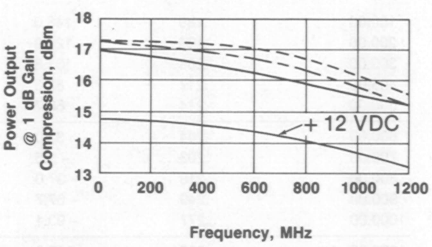
KEY:	
+25°C	———
+85°C	– – –
−55°C	—·—·—



Gain



Noise Figure



Power Output

MAXIMUM RATINGS

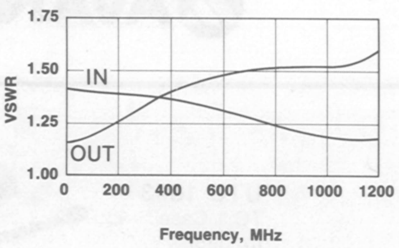
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +100°C

THERMAL CHARACTERISTICS*

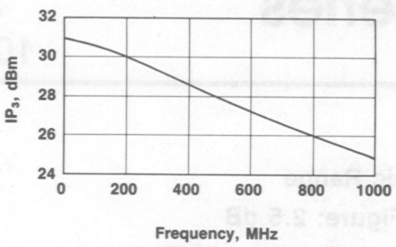
θ_{JC} .... 110°C/W
Active Transistor Power Dissipation .... 400 mW
Junction Temperature Above Case Temperature .... 44°C
MTBF .... 847,163 Hrs.

*For further information, see High Reliability section.

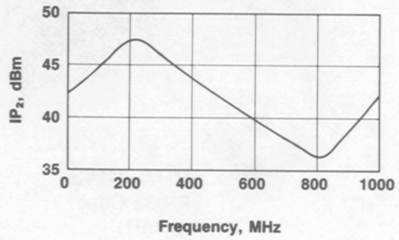
WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



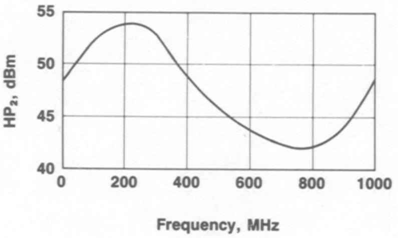
VSWR



Third-Order Intercept Point



Second-Order Intercept Point



Second-Harmonic Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.39	10.53	166.21	1.28	−3.05	.00	1.24	16.18
200.0	1.37	10.45	151.69	.19	−3.03	.39	1.27	16.14
300.0	1.36	10.42	137.51	−.56	−2.69	.40	1.32	16.20
400.0	1.35	10.44	123.83	−.83	−1.85	.36	1.36	16.23
500.0	1.34	10.43	110.55	−.69	−.60	.37	1.41	16.29
600.0	1.32	10.40	97.76	−.05	1.13	.36	1.44	16.33
700.0	1.28	10.38	84.54	.14	2.43	.35	1.48	16.37
800.0	1.25	10.43	71.73	.74	4.15	.38	1.50	16.34
900.0	1.22	10.49	57.96	.40	4.91	.40	1.53	16.36
1000.0	1.20	10.56	43.42	−.71	4.89	.41	1.55	16.44
1100.0	1.20	10.66	27.99	–	4.00	.44	1.59	16.57
1200.0	1.23	10.75	11.66	–	2.21	.47	1.64	16.77
1300.0	1.30	10.81	−5.93	–	−.84	.51	1.71	17.08
1400.0	1.44	10.69	−24.70	–	−5.09	.54	1.79	17.45
1500.0	1.67	10.22	−44.90	–	−10.77	.58	1.90	17.83
1600.0	2.02	9.33	−65.69	–	–	.55	1.93	18.14
1700.0	2.52	8.06	−84.19	–	–	.47	1.91	18.28

LINEARIZATION RANGE: 100.0 TO 1000.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.104	−169.5	10.846	165.1	−15.973	−5.7	.066	134.5
200.00	.113	−168.3	10.700	152.6	−16.157	−12.1	.083	108.2
300.00	.126	−169.6	10.665	138.5	−16.038	−17.7	.105	87.8
400.00	.136	−172.6	10.579	123.5	−16.236	−23.8	.128	71.6
500.00	.147	−178.1	10.561	110.8	−16.090	−30.5	.146	57.8
600.00	.148	176.4	10.430	97.3	−16.184	−37.1	.161	42.7
700.00	.147	170.0	10.411	83.6	−16.148	−41.7	.176	28.9
800.00	.138	162.6	10.377	70.3	−16.223	−48.8	.182	16.4
900.00	.125	154.9	10.456	56.1	−16.076	−56.0	.191	1.1
1000.00	.106	145.3	10.447	42.6	−15.991	−61.7	.198	15.5
1100.00	.081	133.5	10.636	28.2	−16.097	−68.4	.207	−32.0
1200.00	.052	115.6	10.642	12.9	−16.178	−75.4	.221	−49.7
1300.00	.037	68.9	10.752	−4.1	−16.290	−83.9	.241	−70.1
1400.00	.059	13.0	10.790	−21.2	−16.441	−90.4	.265	−90.1
1500.00	.115	−8.4	10.467	−40.4	−16.762	−96.8	.295	−112.3
1600.00	.199	−24.1	9.750	−60.4	−17.071	−102.6	.323	−135.6
1700.00	.302	−39.3	8.771	−80.3	−17.036	−108.2	.335	−157.2
1800.00	.402	−52.3	7.209	−96.1	−17.036	−115.2	.336	−178.6
1900.00	.494	−67.3	5.523	−110.3	−16.990	−122.3	.329	163.1
2000.00	.565	−79.3	3.904	−122.7	−17.141	−129.0	.314	148.4

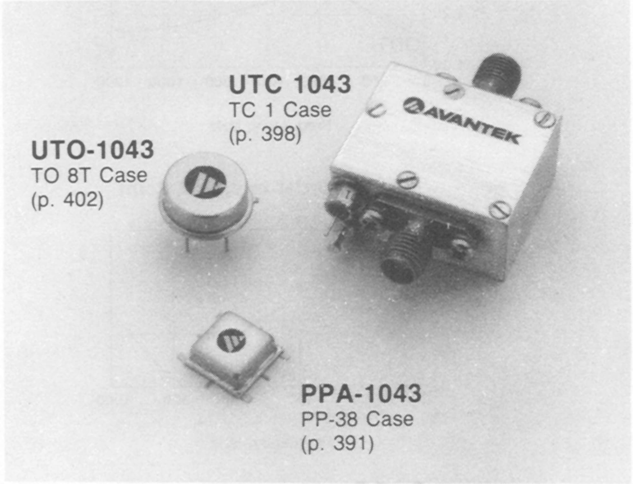
1043 Series

Thin Film Cascadable Amplifier 10-1000 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **Low Noise Figure: 2.5 dB**
- **Medium Output Power: +8 dBm**



ELECTRICAL SPECIFICATIONS[1,2] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	10-1000	10-1000	10-1000	MHz
GP	Small Signal Gain	10.5	10.0 Min.	9.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	2.5	4.0 Max.	4.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+8.0	+6.0 Min.	+6.0 Min.	dBm
—	Input VSWR	<1.7:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.7:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+22.0	—	—	dBm
I_D	DC Current	25	—	—	mA

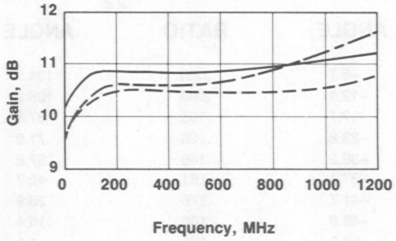
NOTE 1: Both RF input and RF output pins are at DC ground — no blocking capacitor.

NOTE: 2: PPA = Preliminary

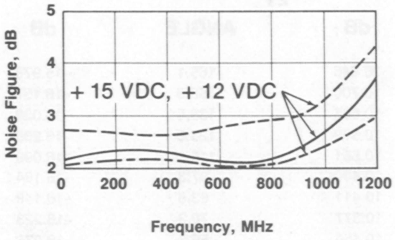
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

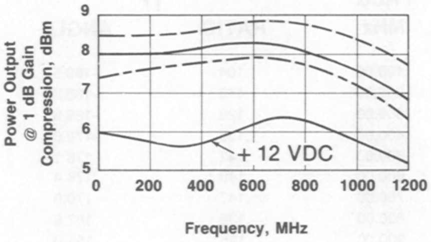
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

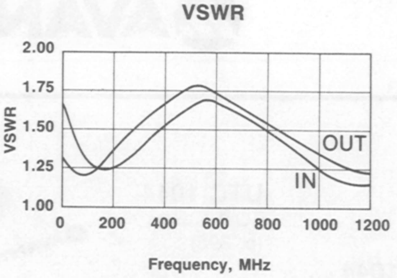
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	120°C/W
Active Transistor Power Dissipation	176 mW
Junction Temperature Above Case Temperature	21°C
MTBF	886,475 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) PPA — 0.5 grams; UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.09	10.77	160.26	–5.71	.00	1.17	16.80
200.0	1.19	10.67	152.36	–4.78	.43	1.35	16.72
300.0	1.29	10.67	137.24	–3.07	.42	1.53	17.08
400.0	1.36	10.72	122.72	–.75	.39	1.69	17.24
500.0	1.39	10.83	108.58	1.94	.40	1.79	17.32
600.0	1.38	10.95	94.02	4.22	.42	1.81	17.39
700.0	1.32	11.05	78.88	5.71	.44	1.74	17.40
800.0	1.22	11.19	61.92	5.79	.48	1.58	17.35
900.0	1.08	11.14	43.90	4.59	.52	1.35	17.29
1000.0	1.08	10.95	25.03	2.56	.54	1.10	17.20
1100.0	1.25	10.43	5.65	.02	.56	1.15	17.43
1200.0	1.44	9.69	–14.26	–3.04	.51	1.45	17.60
1300.0	1.61	8.73	–31.95	–3.90	.47	1.80	18.14
1400.0	1.73	7.63	–48.41	–3.53	.44	2.16	18.72
1500.0	1.80	6.46	–63.92	–2.20	.00	2.56	19.37

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.043	132.7	10.733	167.3	–16.533	169.4	.074	114.0
150.00	.065	104.3	10.682	159.2	–16.771	161.0	.109	96.5
200.00	.088	87.0	10.607	151.1	–16.946	154.2	.149	83.7
250.00	.113	73.5	10.572	143.2	–16.949	147.6	.181	73.9
300.00	.131	65.9	10.599	135.6	–17.247	140.9	.207	65.2
350.00	.146	57.4	10.632	126.0	–17.155	134.5	.233	57.7
400.00	.154	49.2	10.685	120.6	–17.085	129.0	.252	50.8
450.00	.161	41.2	10.757	113.5	–17.273	123.3	.267	43.5
500.00	.163	34.0	10.784	105.9	–17.291	117.7	.277	36.7
550.00	.158	26.5	10.885	98.6	–17.319	112.0	.280	30.0
600.00	.151	20.2	10.965	91.0	–17.320	106.5	.281	23.6
650.00	.142	12.0	11.017	83.1	–17.373	100.9	.273	17.1
700.00	.125	4.5	11.080	75.0	–17.426	96.1	.259	9.9
750.00	.103	–4.6	11.173	66.5	–17.279	90.3	.239	3.0
800.00	.080	–14.7	11.216	57.7	–17.303	84.6	.211	–4.0
850.00	.052	–24.8	11.235	48.6	–17.327	78.6	.176	–11.9
900.00	.017	–53.0	11.167	39.0	–17.281	72.6	.132	–18.4
950.00	.025	177.0	11.113	29.1	–17.233	66.6	.085	–25.8
1000.00	.057	153.7	10.971	19.4	–17.276	60.7	.032	–28.0
1100.00	.131	128.2	10.422	–.7	–17.405	47.6	.083	125.0
1200.00	.188	112.5	9.693	–21.0	–17.669	34.8	.193	112.1
1300.00	.236	88.9	8.713	–39.0	–18.138	22.0	.291	99.6
1400.00	.259	87.9	7.607	–56.0	–18.694	10.0	.368	86.4
1500.00	.279	80.0	6.496	–72.2	–19.401	–1.2	.433	78.7

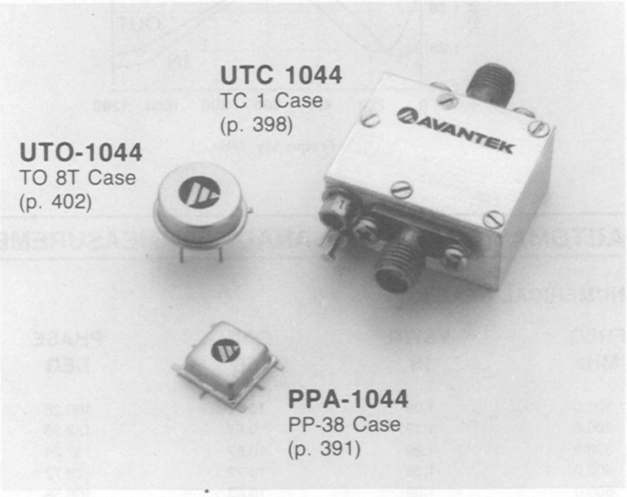
1044 Series

Thin Film Cascadable Amplifier 10-1000 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **Low Noise Figure: 2.5 dB**
- **Medium Output Power: +13.0 dBm**



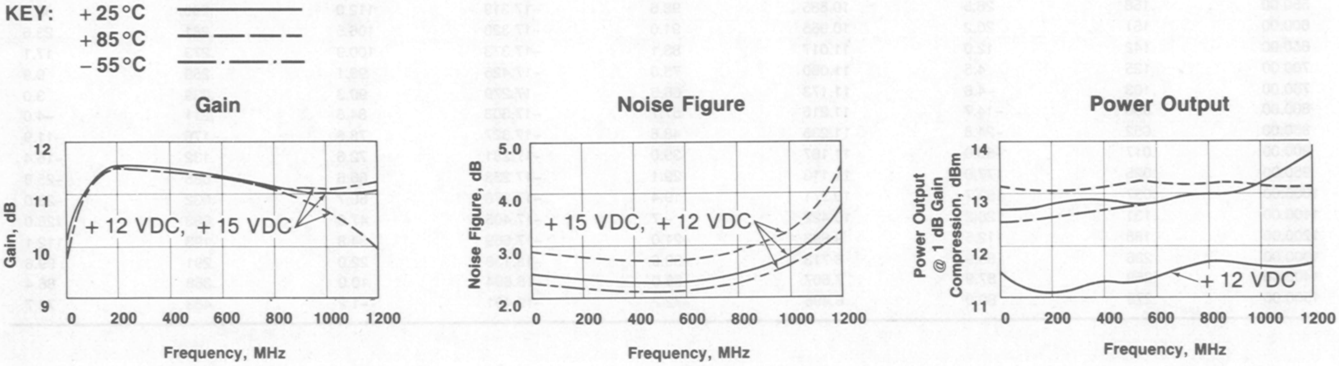
ELECTRICAL SPECIFICATIONS[1,2] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	
BW	Frequency Range	10-1000	10-1000	10-1000	MHz
GP	Small Signal Gain	11.0	10.0 Min.	9.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	2.5	4.5 Max.	5.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+13.0	+12.0 Min.	+12.0 Min.	dBm
—	Input VSWR	<1.8:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.8:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+28.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+40.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+46.0	—	—	dBm
I_D	DC Current	35	—	—	mA

NOTE 1: Both RF input and RF output pins are at DC ground—no blocking capacitor.

2: PPA = Preliminary, Power Output = +10 dBm Min. @ −55° to +85°

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)



MAXIMUM RATINGS

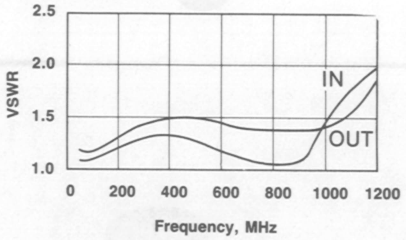
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

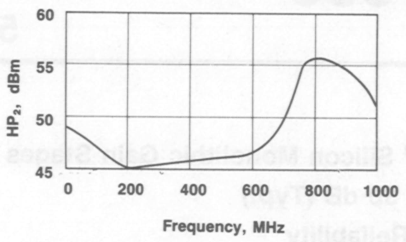
THERMAL CHARACTERISTICS*

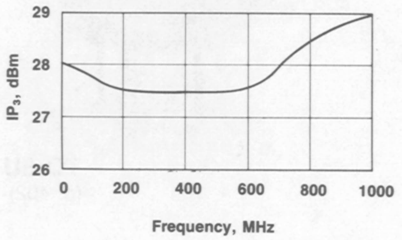
θ_{JC} .... 120°C/W
Active Transistor Power Dissipation .... 256 mW
Junction Temperature Above Case Temperature .... 31°C
MTBF .... 851,353 Hrs.

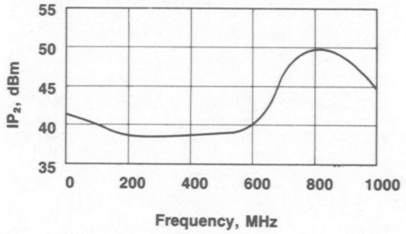
*For further information, see High Reliability section.

WEIGHT: (typical) PPA — 0.5 grams; UTO — 2.1 grams; UTC — 21.5 grams


VSWR


Second Harmonic Intercept Point


Third-Order Intercept Point


Second-Order Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.13	11.12	168.56	–2.87	.00	1.17	16.40
200.0	1.20	11.02	152.79	–2.76	.43	1.28	16.39
300.0	1.27	11.01	137.95	–1.73	.41	1.41	16.56
400.0	1.31	11.04	123.61	–.21	.39	1.49	16.64
500.0	1.30	11.12	109.58	1.63	.39	1.54	16.66
600.0	1.24	11.19	95.25	3.19	.41	1.52	16.52
700.0	1.18	11.21	80.12	3.78	.43	1.45	16.47
800.0	1.02	11.24	63.73	3.42	.47	1.35	16.44
900.0	1.23	11.04	46.58	2.14	.50	1.30	16.33
1000.0	1.51	10.69	28.83	.28	.52	1.40	16.44

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.063	154.8	11.090	167.6	–16.592	169.3	.077	141.1
150.00	.075	120.6	11.053	159.7	–16.417	161.1	.096	114.7
200.00	.089	101.4	10.958	151.8	–16.537	152.8	.124	100.4
250.00	.108	85.3	10.930	143.9	–16.541	146.0	.145	88.3
300.00	.123	75.5	10.946	136.4	–16.639	139.5	.164	79.6
350.00	.130	65.9	10.980	129.0	–16.626	132.6	.182	71.7
400.00	.134	56.4	11.016	121.7	–16.607	126.4	.193	65.0
450.00	.132	46.7	11.073	114.7	–16.601	120.6	.201	58.7
500.00	.127	39.5	11.084	107.2	–16.583	114.3	.207	53.1
550.00	.114	32.6	11.157	100.1	–16.585	108.4	.204	48.6
600.00	.096	24.7	11.202	92.6	–16.565	102.1	.199	44.9
650.00	.075	18.2	11.221	84.7	–16.503	96.5	.189	41.8
700.00	.046	15.5	11.228	76.9	–16.470	90.3	.176	40.5
750.00	.011	28.3	11.254	68.7	–16.407	84.4	.160	41.8
800.00	.028	156.2	11.233	60.2	–16.406	77.7	.144	46.0
850.00	.072	153.9	11.183	51.5	–16.434	71.0	.135	53.9
900.00	.123	147.5	11.062	42.5	–16.370	64.7	.136	65.3
950.00	.173	140.7	10.896	33.2	–16.366	58.1	.148	75.0
1000.00	.220	133.4	10.691	24.3	–16.460	51.8	.174	82.9
1050.00	.269	123.8	10.378	14.5	–16.543	45.4	.212	85.8
1100.00	.316	116.2	10.038	5.5	–16.648	38.8	.251	86.3
1200.00	.390	101.4	9.272	–11.7	–17.028	26.0	.326	82.0
1300.00	.449	87.8	8.368	–27.1	–17.369	14.3	.393	74.7
1400.00	.486	75.0	7.393	–41.8	–17.792	3.8	.445	67.0
1500.00	.511	64.0	6.429	–55.2	–18.261	–6.5	.484	60.0

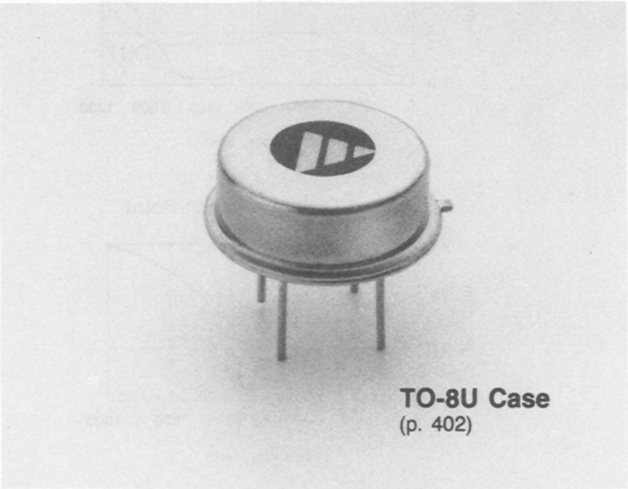
UTM-1053

High Gain Modular Amplifier 5-1000 MHz

AVANTEK

FEATURES

- **MODAMP™ Silicon Monolithic Gain Stages**
- **High Gain: 30 dB (Typ.)**
- **Increased Reliability**



TO-8U Case
(p. 402)

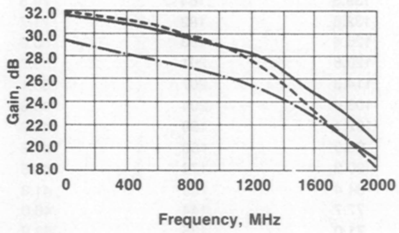
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +71°C$	Unit
BW	Frequency Range	5-1000	5-1000	5-1000	MHz
GP	Small Signal Gain	30.0	27.0 Min.	25.0 Min.	dB
—	Gain Flatness	±1.5	±2.0 Max.	±2.0 Max.	dB
NF	Noise Figure	8.0	9.0 Max.	9.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+9.0	+5.0 Min.	+4.0 Min.	dBm
—	Input VSWR	1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+21.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+30.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+45.0	—	—	dBm
I_D	DC Current	90		—	mA

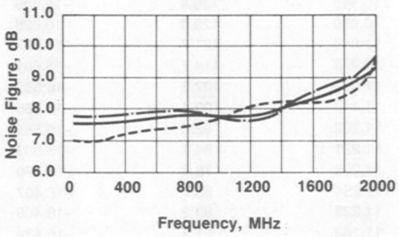
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+71°C — — — —
−55°C —·—·—

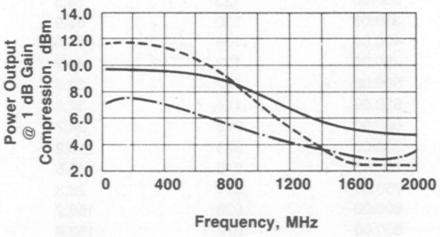
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +17 dBm
Operating Case Temperature .... −55°C to +71°C
Storage Temperature .... −62°C to +71°C
"R" Series Burn-In Temperature .... +71°C

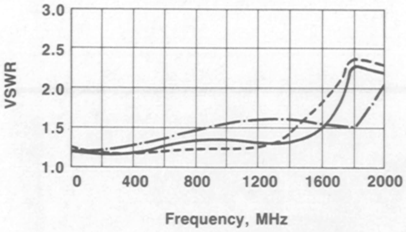
THERMAL CHARACTERISTICS

θ_{JC} [1] .... 240/240/240°C/W
Active Transistor Power Dissipation[1] .... 250/250/250 mW
Junction Temperature Above Case Temperature[1] . 60/60/84°C

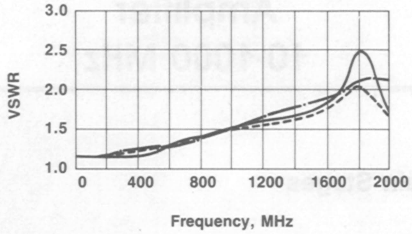
Note 1: Values refer to 1st and 2nd stage transistors respectively.

WEIGHT: (typical) — 2.1 grams

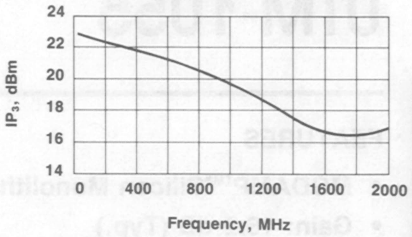
Input VSWR



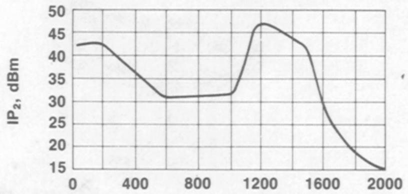
Output VSWR



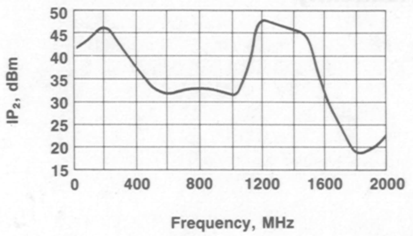
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.15	31.10	2.01	.00	1.06	43.20
200.0	1.08	30.79	.12	.74	1.13	48.73
300.0	1.12	30.46	–.76	.67	1.15	58.84
400.0	1.16	30.11	–.94	.68	1.20	55.41
500.0	1.22	29.90	–.96	.66	1.24	51.72
600.0	1.27	29.77	–.07	.65	1.30	54.65
700.0	1.31	29.48	.17	.67	1.33	49.54
800.0	1.36	29.20	.60	.68	1.39	51.27
900.0	1.39	28.99	.34	.69	1.43	49.36
1000.0	1.41	28.85	–.55	.70	1.49	47.69

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**
90.20 MA

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.055	–166.8	31.488	159.6	–49.622	23.4	.041	–18.5
150.00	.044	–162.6	31.381	148.6	–52.352	8.1	.048	–16.8
200.00	.044	–151.7	31.268	137.8	–54.150	39.4	.058	–24.8
250.00	.049	–139.7	31.171	128.3	–55.565	80.8	.064	–33.3
300.00	.051	–127.9	31.000	118.6	–59.922	73.1	.067	–39.4
350.00	.059	–118.6	30.855	109.3	–62.893	30.4	.080	–45.1
400.00	.069	–115.4	30.656	100.1	–58.065	91.3	.088	–50.9
450.00	.080	–109.4	30.510	90.7	–56.606	54.3	.098	–55.2
500.00	.090	–109.4	30.398	81.6	–59.501	70.4	.110	–60.7
550.00	.101	–108.8	30.297	72.5	–60.129	47.5	.121	–64.0
600.00	.113	–110.1	30.230	63.6	–55.868	61.5	.133	–67.3
650.00	.123	–110.7	30.113	54.6	–53.130	96.5	.144	–69.9
700.00	.132	–112.5	29.959	45.6	–55.095	70.4	.152	–73.8
750.00	.140	–115.8	29.853	36.4	–54.666	85.4	.164	–77.6
800.00	.149	–119.4	29.662	26.8	–51.949	80.2	.176	–78.5
850.00	.155	–122.0	29.525	16.8	–53.425	106.0	.181	–79.9
900.00	.159	–124.5	29.375	6.9	–51.872	93.9	.186	–82.6
950.00	.166	–128.1	29.324	–3.2	–50.651	113.6	.198	–84.3
1000.00	.169	–130.1	29.172	–13.0	–51.330	100.3	.206	–84.9
1100.00	.167	–132.8	28.807	–32.5	–49.174	118.9	.216	–88.3
1200.00	.163	–132.6	28.347	–52.9	–46.878	123.1	.233	–89.2
1300.00	.156	–129.7	27.681	–72.8	–46.023	116.7	.242	–91.5
1400.00	.157	–123.8	26.792	–92.0	–44.046	115.0	.259	–92.8
1500.00	.171	–117.3	25.869	–109.8	–42.855	112.2	.270	–94.0
1600.00	.204	–112.8	24.811	–126.6	–40.686	112.2	.301	–97.7
1700.00	.222	–109.9	23.520	–142.2	–38.903	108.0	.292	–100.5
1800.00	.389	–95.2	23.283	–154.1	–35.449	53.8	.427	–93.3
1900.00	.394	–126.1	21.584	–175.4	–44.824	72.7	.352	–120.1
2000.00	.363	–137.2	20.254	172.3	–41.273	95.2	.280	–123.3

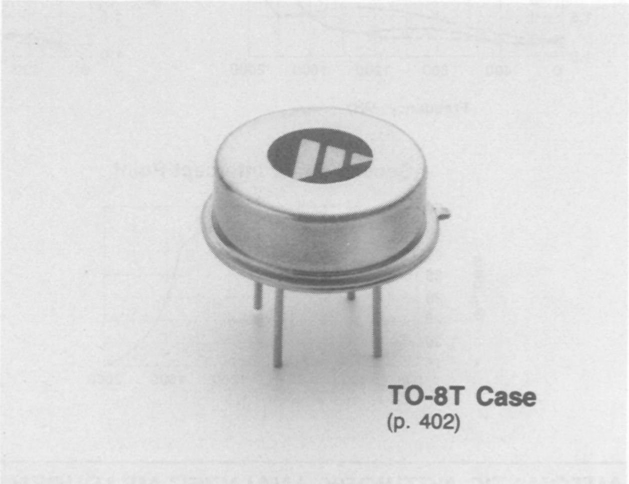
REFERENCE PLANES = 8.65 8.65 17.30

UTM-1055

High Gain Modular Amplifier 10-1000 MHz

FEATURES

- **MODAMP™ Silicon Monolithic Gain Stages**
- **Gain: 16.2 dB (Typ.)**
- **Output Power: +16.5 dBm (Typ.)**
- **Increased Reliability**



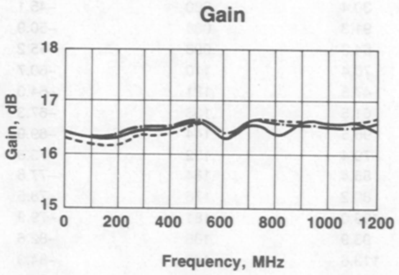
TO-8T Case
(p. 402)

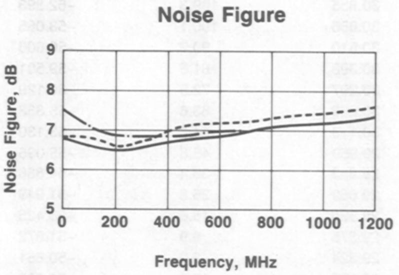
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

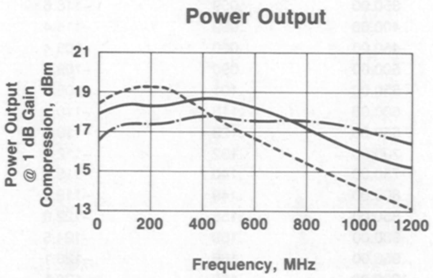
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = -55°- +85°C	
BW	Frequency Range	10-1000	10-1000	10-1000	MHz
GP	Small Signal Gain	16.2	15.5 Min.	15.0 Min.	dB
—	Gain Flatness	±0.2	±0.7 Max.	±0.7 Max.	dB
NF	Noise Figure	7.0	8.0 Max.	8.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+16.5	+15.0 Min.	+12.0 Min.	dBm
—	Input VSWR	1.4:1	1.7:1 Max.	1.7:1 Max.	—
—	Output VSWR	1.2:1	1.7:1 Max.	1.7:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+29.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+45.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+50.0	—	—	dBm
I_D	DC Current	135		—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—







MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +20 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +85°C

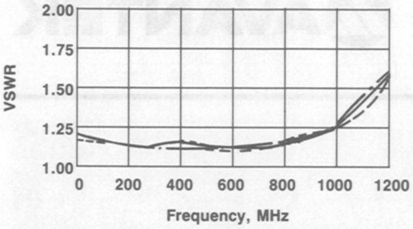
THERMAL CHARACTERISTICS

θ_{JC} [1] .... 110/110°C/W
Active Transistor Power Dissipation[1] .... 300/480 mW
Junction Temperature Above Case Temperature[1] .... 33/53°C

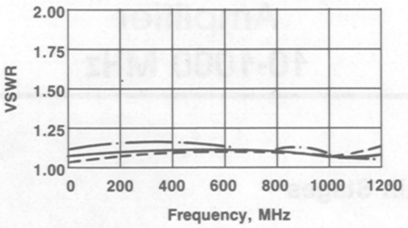
Note 1: Values refer to 1st and 2nd stage transistors respectively.

WEIGHT: (typical) — 2.1 grams

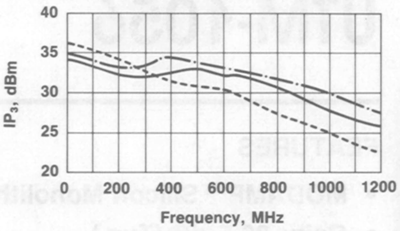
Input VSWR



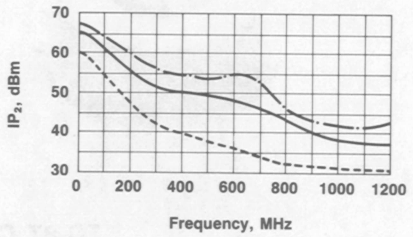
Output VSWR



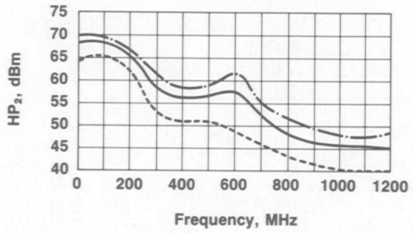
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEV	GPDEL NSEC	VSWR OUT
100.0	1.13	16.36	–.86	.00	1.21
200.0	1.14	16.42	.05	.44	1.22
300.0	1.14	16.33	.97	.46	1.22
400.0	1.15	16.16	.66	.49	1.22
500.0	1.16	16.15	–.61	.48	1.22
600.0	1.17	16.38	–.41	.45	1.22
700.0	1.19	16.41	.08	.45	1.22
800.0	1.22	16.47	.37	.46	1.20
900.0	1.28	16.34	.27	.48	1.16
1000.0	1.34	16.26	–.52	.48	1.10
1100.0	1.44	16.33		.48	1.02
1200.0	1.54	16.29		.51	1.07
1300.0	1.68	16.20		.55	1.22
1400.0	1.67	16.35		.55	1.42
1500.0	2.09	16.72		.61	1.77
1600.0	2.43	16.39		.67	2.30
1700.0	2.76	15.84		.69	3.07
1800.0	2.94	14.66		.67	4.13
1900.0	2.91	13.48		.62	4.99
2000.0	2.86	11.73		.00	5.60

LINEARIZATION RANGE: 100.0 TO 1000.0
REFERENCE PLANES = .00 .00 .00

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**
135 MA

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.063	178.8	16.304	–14.9	–34.067	–.2	.098	–2.9
200.00	.059	177.2	16.207	–32.6	–33.592	–8.9	.097	–4.4
300.00	.061	173.8	16.335	–48.4	–33.762	–15.9	.102	–7.6
400.00	.069	168.2	16.275	–65.0	–33.633	–22.0	.101	–13.8
500.00	.073	167.9	16.419	–61.4	–34.070	–28.1	.104	–18.7
600.00	.074	161.3	16.126	–98.9	–33.520	–33.9	.100	–21.4
700.00	.082	156.2	16.321	–116.2	–33.174	–40.5	.107	–30.5
800.00	.100	159.7	16.293	–131.8	–33.250	–44.6	.094	–42.0
900.00	.115	157.1	16.348	–148.4	–33.425	–55.5	.077	–53.8
1000.00	.136	149.1	16.218	–167.0	–32.975	–61.9	.051	–61.3
1100.00	.169	143.1	16.226	175.0	–33.039	–73.2	.014	–64.4
1200.00	.202	133.4	16.332	157.2	–32.542	–79.2	.037	95.5
1300.00	.253	124.0	16.361	140.5	–32.933	–88.4	.096	84.2
1400.00	.295	114.8	16.243	119.5	–33.252	–101.1	.175	69.1
1500.00	.345	99.3	16.344	99.3	–34.293	–108.0	.249	59.0
1600.00	.399	88.8	16.250	74.7	–32.900	–124.8	.404	42.0
1700.00	.434	75.2	15.709	53.1	–32.877	–149.0	.504	24.4
1800.00	.478	61.6	14.750	27.9	–35.599	–173.2	.599	5.8
1900.00	.467	49.4	13.191	4.7	–37.513	168.1	.671	–11.3
2000.00	.465	40.0	11.532	–14.2	–39.584	142.2	.708	–25.2

REFERENCE PLANES = .00 .00 .00

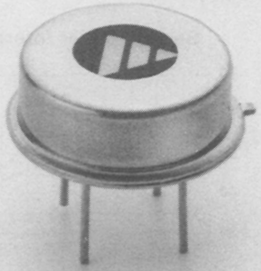
UTM-1056

High Gain Modular Amplifier 10-1000 MHz

AVANTEK

FEATURES

- **MODAMP™ Silicon Monolithic Gain Stages**
- **Gain: 26.5 dB (Typ.)**
- **Increased Reliability**



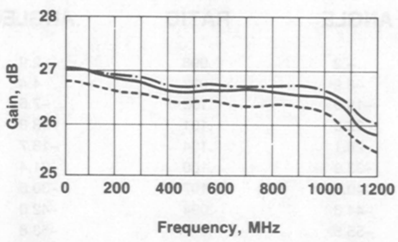
TO-8T Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

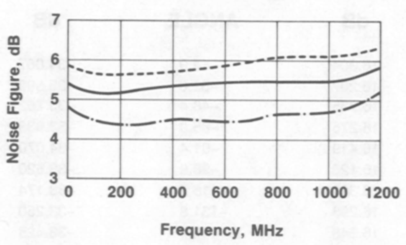
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$		Unit
			$T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	
BW	Frequency Range	10-1000	10-1000	10-1000	MHz
GP	Small Signal Gain	26.5	25.5 Min.	25.0 Min.	dB
—	Gain Flatness	±0.2	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	5.5	6.5 Max.	7.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+13.5	+12.0 Min.	+10.5 Min.	dBm
—	Input VSWR	1.4:1	1.7:1 Max.	1.7:1 Max.	—
—	Output VSWR	1.4:1	1.7:1 Max.	1.7:1 Max.	
IP_3	Two Tone 3rd Order Intercept Point	+26.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+35.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+40.0	—	—	dBm
I_D	DC Current	135		—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

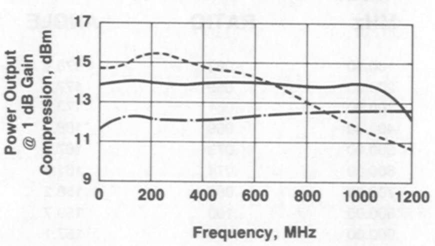
KEY:
+25°C ————
+85°C — — — —
-55°C —·—·—



Gain



Noise Figure



Power Output

MAXIMUM RATINGS

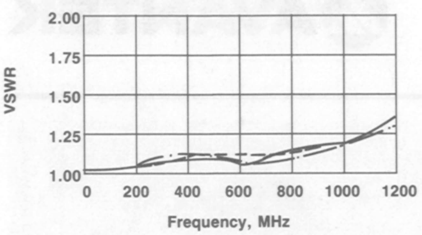
DC Voltage .... +17 Volts
Continuous RF Input Power .... +20 dBm
Operating Case Temperature .... -55°C to +100°C
Storage Temperature .... -62°C to +150°C
"R" Series Burn-In Temperature .... +100°C

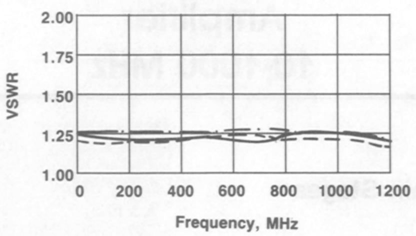
THERMAL CHARACTERISTICS

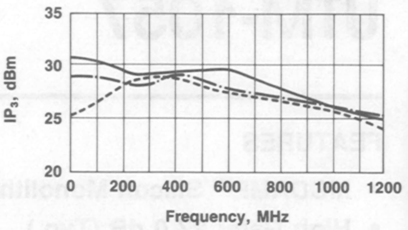
θ_{JC}[1] .... 80/110/110°C/W
Active Transistor Power Dissipation[1] .... 175/250/300 mW
Junction Temperature Above Case Temperature[1] . 14/26/33°C

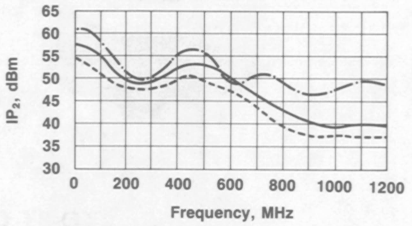
Note 1: Values refer to 1st and 2nd stage transistors respectively.

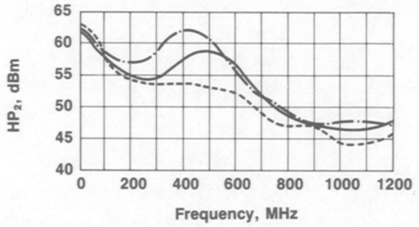
WEIGHT: (typical) — 2.1 grams


Input VSWR


Output VSWR


Third-Order Intercept Point


Second-Order Intercept Point


Second Harmonic Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEV	GPDEL NSEC	VSWR OUT
100.0	1.06	27.11	–1.39	.00	1.16
200.0	1.04	26.99	–.77	.67	1.21
300.0	1.05	26.73	–.48	.67	1.23
400.0	1.06	26.48	.18	.66	1.26
500.0	1.05	26.52	.94	.65	1.30
600.0	1.06	26.76	2.49	.67	1.30
700.0	1.13	26.68	1.91	.71	1.31
800.0	1.18	26.70	.47	.72	1.34
900.0	1.22	26.70	–.39	.73	1.31
1000.0	1.28	26.49	–2.96	.77	1.24
1100.0	1.36	26.12		.79	1.14
1200.0	1.44	25.73		.79	1.09
1300.0	1.55	25.00		.80	1.30
1400.0	1.70	23.67		.78	1.63
1500.0	1.68	23.16		.79	1.87
1600.0	1.72	21.70		.81	2.50
1700.0	1.77	19.89		.75	3.20
1800.0	1.81	17.56		.70	3.82
1900.0	1.76	15.65		.63	4.18
2000.0	1.70	13.62		.00	4.46

LINEARIZATION RANGE: 100.0 TO 1000.0
REFERENCE PLANES = .00 .00 .00

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS
135 MA

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.005	66,7	26,968	155,9	–58.461	–86.5	.095	4.2
200.00	.014	71.0	26.819	129.9	–51.146	–18.7	.096	7.3
300.00	.022	60.6	26.771	107.9	–62.887	29.9	.105	4.0
400.00	.029	66.4	26.495	82.6	–52.593	–9.4	.117	1.2
500.00	.016	74.1	26.567	59.1	–55.136	–.8	.132	–4.7
600.00	.017	95.3	26.513	35.1	–52.968	–21.2	.134	–13.2
700.00	.062	112.8	26.689	10.1	–51.633	–26.9	.128	–18.2
800.00	.074	99.2	26.636	–15.3	–51.910	–39.9	.148	–26.9
900.00	.078	91.6	26.532	–41.2	–52.173	–66.5	.144	–44.3
1000.00	.107	84.8	26.515	–68.2	–53.165	–61.3	.115	–64.6
1100.00	.134	84.6	25.953	–96.9	–52.159	–82.0	.060	–99.7
1200.00	.170	74.9	25.763	–125.3	–51.498	–78.5	.041	151.7
1300.00	.213	67.3	24.976	–153.2	–55.669	–95.1	.123	96.2
1400.00	.241	55.5	24.022	178.3	–57.330	–76.3	.235	66.2
1500.00	.284	39.1	22.711	150.5	–50.292	.6	.299	41.7
1600.00	.257	27.7	21.627	120.4	–48.659	–44.7	.433	31.8
1700.00	.256	21.9	19.874	94.0	–50.520	–117.8	.524	12.1
1800.00	.274	15.5	17.720	68.4	–58.857	–33.9	.580	–5.3
1900.00	.267	6.7	15.558	45.4	–55.695	–39.2	.618	–18.5
2000.00	.258	–.8	13.380	25.0	–58.326	–30.1	.643	–29.6

REFERENCE PLANES = .00 .00 .00

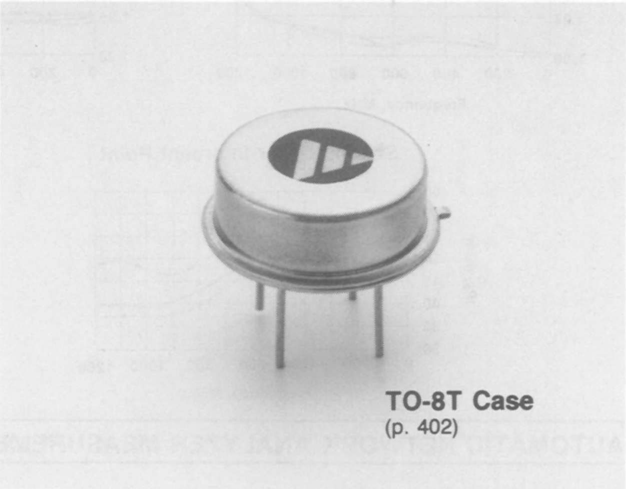
UTM-1057

High Gain Modular Amplifier
10-1000 MHz

AVANTEK

FEATURES

- **MODAMP™ Silicon Monolithic Gain Stages**
- **High Gain: 27.0 dB (Typ.)**
- **Increased Reliability**



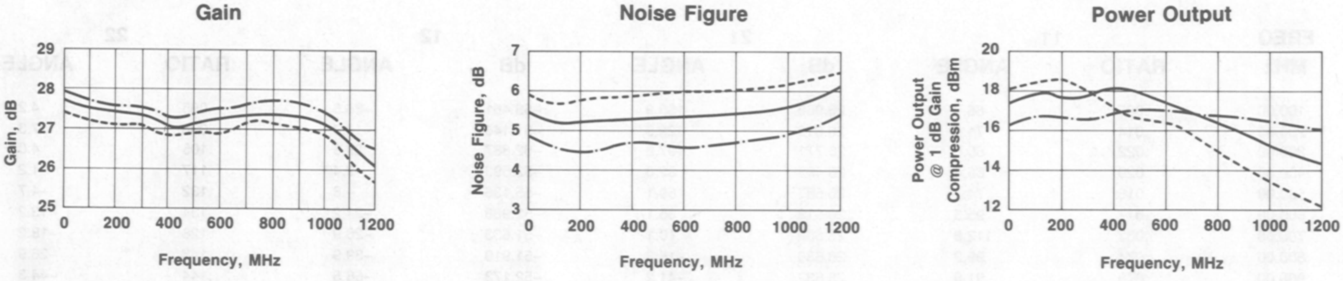
TO-8T Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = -55°- +85°C	
BW	Frequency Range	10-1000	10-1000	10-1000	MHz
GP	Small Signal Gain	27.0	26.0 Min.	25.5 Min.	dB
—	Gain Flatness	±0.2	±0.7 Max.	±1.0 Max.	dB
NF	Noise Figure	5.5	6.5 Max.	7.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+15.5	+14.0 Min.	+12.5 Min.	dBm
—	Input VSWR	1.4:1	1.7:1 Max.	1.7:1 Max.	—
—	Output VSWR	1.3:1	1.7:1 Max.	1.7:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+29.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+42.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+48.0	—	—	dBm
I_D	DC Current	170		—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
−55°C —·—·—



MAXIMUM RATINGS

DC Voltage . . . . +17 Volts
Continuous RF Input Power . . . . +20 dBm
Operating Case Temperature . . . . -55°C to +100°C
Storage Temperature . . . . -62°C to +150°C
"R" Series Burn-In Temperature . . . . +100°C

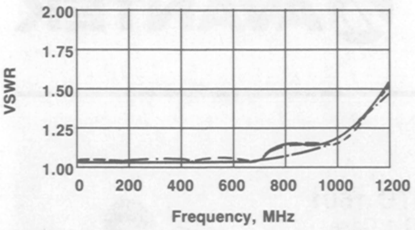
THERMAL CHARACTERISTICS

θ_{JC} [1] . . . . 80/110/110°C/W
Active Transistor Power Dissipation[1] . . . . 175/300/480 mW
Junction Temperature Above Case Temperature[1] . 14/33/53°C

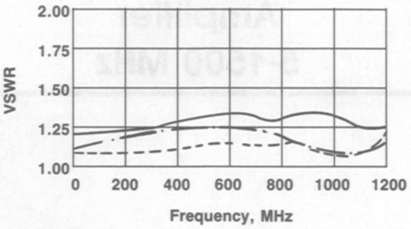
Note 1: Values refer to 1st and 2nd stage transistors respectively.

WEIGHT: (typical) — 2.1 grams

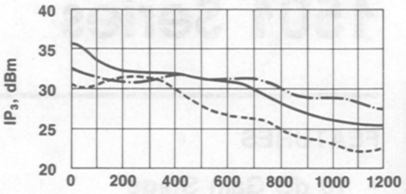
Input VSWR



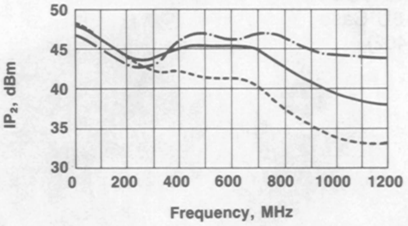
Output VSWR



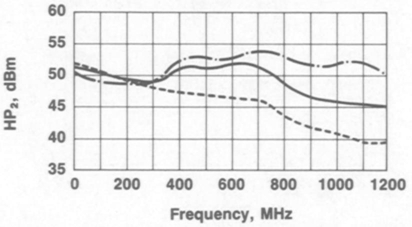
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEV	GPDEL NSEC	VSWR OUT
100.0	1.05	27.60	−2.30	.00	1.14
200.0	1.05	27.49	−1.39	.66	1.16
300.0	1.06	27.27	−.62	.66	1.18
400.0	1.06	27.06	.63	.65	1.21
500.0	1.05	27.11	1.84	.65	1.24
600.0	1.07	27.48	3.48	.68	1.22
700.0	1.15	27.46	2.76	.72	1.24
800.0	1.20	27.52	.95	.74	1.25
900.0	1.26	27.55	−.81	.76	1.21
1000.0	1.34	27.28	−4.54	.80	1.11
1100.0	1.43	26.74		.80	1.07
1200.0	1.53	26.07		.79	1.27
1300.0	1.65	25.02		.74	1.62
1400.0	1.70	23.82		.76	1.82
1500.0	1.71	23.06		.80	2.54
1600.0	1.75	21.50		.77	3.34
1700.0	1.80	19.76		.73	4.29
1800.0	1.82	17.35		.67	5.03
1900.0	1.75	15.42		.60	5.34
2000.0	1.66	13.42		.00	5.57

LINEARIZATION RANGE: 100.0 TO 1000.0
REFERENCE PLANES = .00 .00 .00

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS 170 MA**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.008	114.1	27.481	156,1	−48.333	19.4	.063	2.7
200.00	.019	71.2	27.369	130.1	−54.226	−30.7	.076	11.8
300.00	.028	62.1	27.334	108.1	−59.069	−56.6	.085	11.6
400.00	.036	60.9	27.044	83.6	−55.500	−53.7	.094	10.4
500.00	.025	61.7	27.153	60.4	−58.835	−4.4	.108	−6.7
600.00	.015	108.1	27.207	38.7	−53.476	−7.4	.106	−6.0
700.00	.077	101.7	27.355	10.7	−53.406	−59.9	.109	5.0
800.00	.082	99.9	27.463	−14.4	−52.683	−43.3	.119	−13.2
900.00	.095	99.0	27.429	−41.3	−53.902	−69.2	.104	−36.1
1000.00	.130	89.5	27.363	−69.8	−52.103	−53.8	.060	−65.7
1100.00	.165	84.9	26.608	−99.6	−52.052	−80.9	.033	161.3
1200.00	.202	74.7	26.158	−128.6	−55.613	−49.7	.121	113.0
1300.00	.241	66.5	25.094	−155.9	−62.287	−98.2	.226	88.4
1400.00	.272	54.2	23.788	176.9	−55.422	37.3	.334	60.2
1500.00	.251	40.3	22.988	150.6	−48.524	−32.6	.412	50.9
1600.00	.268	33.5	21.404	121.2	−49.941	−54.1	.551	31.9
1700.00	.263	27.5	19.688	95.8	−53.413	−108.7	.625	12.2
1800.00	.273	21.7	17.533	71.2	−54.797	−21.7	.662	−5.3
1900.00	.264	12.6	15.331	49.3	−55.126	−18.8	.687	−18.7
2000.00	.242	6.4	13.173	30.1	−52.753	−34.2	.707	−30.5

REFERENCE PLANES = .00 .00 .00

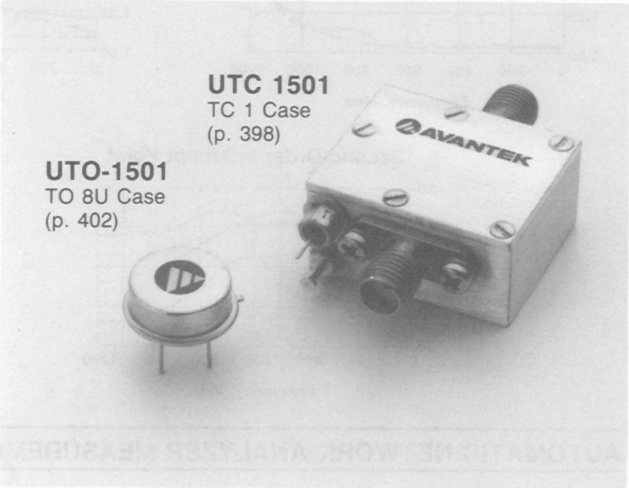
1501 Series

Thin Film Cascadable Amplifier 5-1500 MHz

AVANTEK

FEATURES

- **10 dB Gain Stage**



UTC 1501
TC 1 Case
(p. 398)

UTO-1501
TO 8U Case
(p. 402)

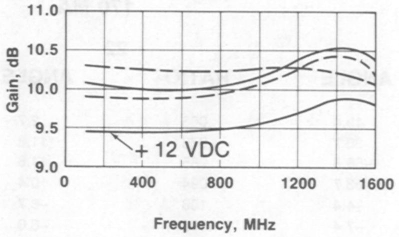
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		T_C = 25°C	T_C = 0°-50°C	T_C = -55°- +85°C	
BW	Frequency Range	5-1500	5-1500	5-1500	MHz
GP	Small Signal Gain	10.0	9.0 Min.	8.5 Min.	dB
—	Gain Flatness	±0.3	±0.5 Max.	±1.0 Max.	dB
NF	Noise Figure	4.5	5.5 Max.	6.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+0.0	−3.0 Min.	−4.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+10.0	—	—	dBm
I_D	DC Current	10	—	—	mA

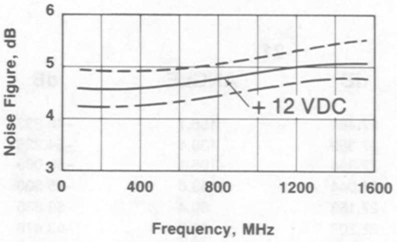
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ———
+85°C — — —
−55°C —·—·—

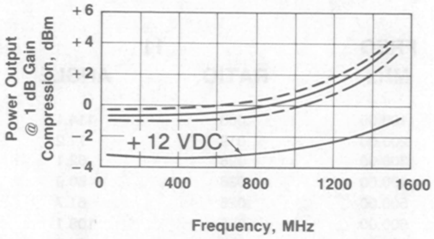
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

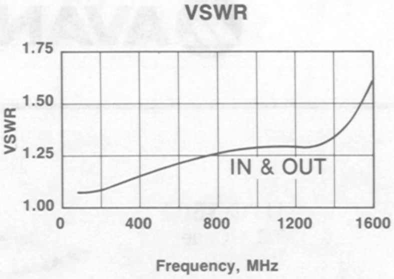
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... -55°C to +125°C
Storage Temperature .... -62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 155°C/W
Active Transistor Power Dissipation .... 67 mW
Junction Temperature Above Case Temperature .... 10°C
MTBF .... 1,052,880 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.10	10.19	164.95	− 4.66	− 1.96	—	1.15	16.20
200.0	1.11	10.04	150.08	− 4.27	− 2.11	.41	1.16	16.30
300.0	1.14	10.04	135.54	− 3.55	− 1.94	.40	1.19	16.33
400.0	1.17	10.10	121.40	− 2.42	− 1.36	.38	1.23	16.38
500.0	1.20	10.14	107.77	− .79	− .28	.38	1.26	16.39
600.0	1.24	10.13	94.43	1.12	1.08	.38	1.29	16.42
700.0	1.26	10.12	80.64	2.59	2.00	.39	1.32	16.45
800.0	1.31	10.16	66.67	3.87	2.74	.39	1.33	16.44
900.0	1.34	10.22	52.40	4.87	3.19	.41	1.35	16.43
1000.0	1.38	10.32	37.60	5.34	3.11	.42	1.35	16.42
1100.0	1.40	10.45	22.23	5.22	2.45	.43	1.36	16.40
1200.0	1.42	10.62	6.34	4.57	1.25	.46	1.36	16.38
1300.0	1.45	10.77	− 10.21	3.28	− .58	.47	1.38	16.34
1400.0	1.51	10.89	− 27.54	1.21	− 3.20	.49	1.42	16.26
1500.0	1.64	10.87	− 45.92	− 1.90	− 6.86	.54	1.52	16.21
1600.0	1.89	10.74	− 66.18	− 6.89	—	.57	1.67	16.28
1700.0	2.31	10.46	− 86.81	− 12.26	—	.57	1.87	16.55
1800.0	2.91	9.77	− 107.06	—	—	.56	2.10	17.04
LINEARIZATION RANGE:			100.0 TO 1700.0	100.0 TO 1500.0	100.0 TO 1500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
100.00	.076	− 171.7	3.153	165.4	.155	− 6.0	.094	157.3
200.00	.080	− 170.0	3.129	151.9	.154	− 11.5	.101	135.5
300.00	.089	− 169.4	3.096	138.2	.154	− 17.5	.113	116.1
400.00	.097	− 169.5	3.107	124.3	.153	− 23.1	.126	100.3
500.00	.108	− 173.5	3.129	110.8	.151	− 29.2	.137	87.2
600.00	.118	− 177.6	3.135	97.9	.151	− 35.7	.146	76.0
700.00	.128	177.6	3.131	84.8	.151	− 42.0	.151	64.9
800.00	.138	171.1	3.133	71.4	.151	− 48.3	.153	55.5
900.00	.144	162.6	3.154	57.8	.150	− 54.7	.153	45.8
1000.00	.150	152.7	3.155	44.0	.151	− 61.1	.148	38.2
1100.00	.150	142.1	3.195	29.7	.152	− 67.3	.142	31.1
1200.00	.150	127.0	3.230	14.8	.152	− 74.4	.137	27.3
1300.00	.155	108.3	3.267	− .8	.153	− 81.8	.134	23.9
1400.00	.166	85.2	3.304	− 17.0	.154	− 89.7	.137	23.1
1500.00	.194	59.8	3.316	− 33.5	.155	− 98.5	.150	20.5
1600.00	.242	35.1	3.276	− 51.1	.155	− 107.6	.175	16.8
1700.00	.315	12.9	3.208	− 70.3	.154	− 116.9	.208	7.9

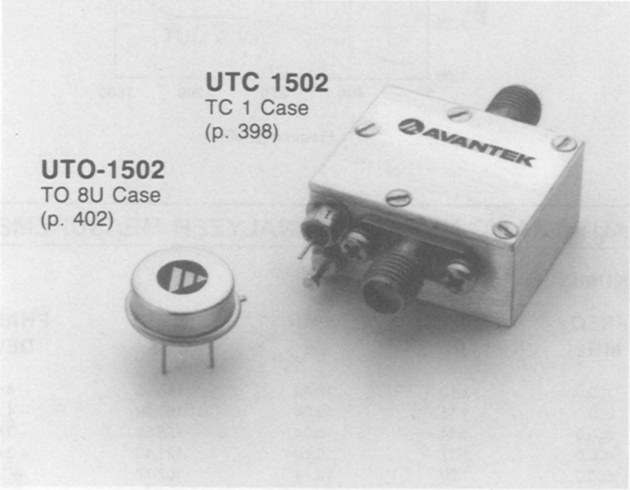
1502 Series

Thin Film Cascadable Amplifier
5-1500 MHz

AVANTEK

FEATURES

- **10.5 dB Gain Stage**


UTC 1502
TC 1 Case
(p. 398)

UTO-1502
TO 8U Case
(p. 402)

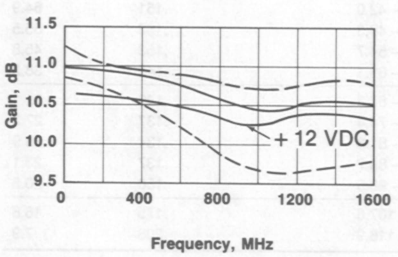
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	 T_C = −55°- +85°C	Unit
BW	Frequency Range	5-1500	5-1500	5-1500	MHz
GP	Small Signal Gain	10.5	9.0 Min.	8.5 Min.	dB
—	Gain Flatness	±0.3	±0.5 Max.	±1.0 Max.	dB
NF	Noise Figure	5.0	7.5 Max.	7.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+8.0	+6.0 Min.	+6.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+19.0	—	—	dBm
I_D	DC Current	23	—	—	mA

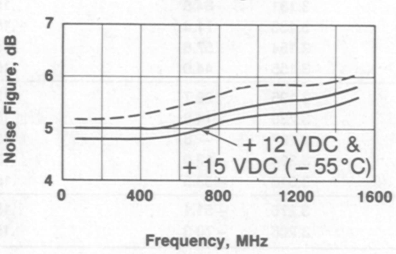
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

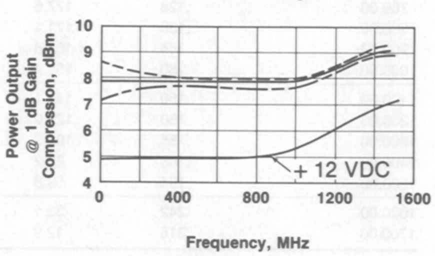
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

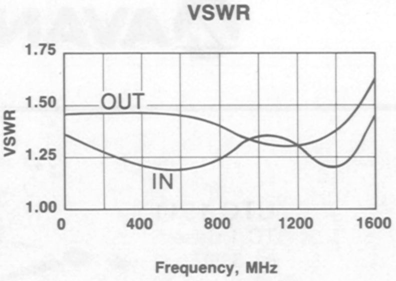
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	155°C/W
Active Transistor Power Dissipation	120 mW
Junction Temperature Above Case Temperature	18.6°C
MTBF	929,937 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.25	11.04	164.12	−2.82	−.48	—	1.45	17.16
200.0	1.22	10.88	148.78	−2.78	−.91	.44	1.45	17.14
300.0	1.19	10.82	133.24	−2.94	−1.55	.42	1.44	17.10
400.0	1.15	10.83	118.45	−2.35	−1.43	.40	1.44	17.05
500.0	1.14	10.80	104.26	−1.16	−.72	.40	1.43	16.95
600.0	1.14	10.72	90.23	.18	.15	.39	1.42	16.85
700.0	1.16	10.60	76.47	1.79	1.29	.39	1.40	16.76
800.0	1.21	10.53	62.18	2.90	1.92	.39	1.39	16.67
900.0	1.25	10.46	47.76	3.88	2.42	.41	1.37	16.54
1000.0	1.29	10.42	32.74	4.24	2.31	.42	1.35	16.44
1100.0	1.31	10.44	17.54	4.41	2.01	.42	1.33	16.33
1200.0	1.29	10.48	1.76	4.02	1.14	.45	1.32	16.25
1300.0	1.25	10.54	−14.38	3.25	−.10	.46	1.32	16.11
1400.0	1.18	10.59	−31.37	1.65	−2.17	.48	1.38	15.91
1500.0	1.22	10.53	−49.48	−1.07	−5.37	.53	1.49	15.78
1600.0	1.44	10.40	−69.57	−5.78	—	.57	1.68	15.78
1700.0	1.86	10.11	−90.21	−11.04	—	.57	1.94	16.01
1800.0	2.52	9.37	−110.81	—	—	.58	2.24	16.58
LINEARIZATION RANGE:				100.0 TO 1700.0	100.0 TO 1500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
100.00	.099	−177.6	3.459	162.8	.145	−4.1	.185	161.5
200.00	.088	174.3	3.406	149.9	.145	−9.0	.185	143.8
300.00	.073	172.8	3.386	134.9	.148	−14.7	.192	125.5
400.00	.057	−179.9	3.305	119.7	.146	−19.9	.194	109.1
500.00	.046	−161.8	3.312	105.9	.150	−27.1	.197	94.7
600.00	.051	−137.7	3.259	92.1	.151	−32.5	.195	80.7
700.00	.067	−124.6	3.233	77.4	.155	−38.4	.191	68.0
800.00	.088	−121.1	3.209	63.9	.153	−45.1	.184	57.3
900.00	.105	−124.1	3.201	48.9	.156	−53.2	.175	47.8
1000.00	.118	−128.3	3.172	35.2	.160	−59.3	.157	40.6
1100.00	.121	−134.9	3.212	20.1	.160	−66.0	.148	35.6
1200.00	.110	−141.4	3.179	5.8	.161	−74.0	.134	36.9
1300.00	.088	−150.1	3.197	−10.8	.165	−83.9	.136	38.7
1400.00	.044	−153.0	3.242	−27.1	.167	−90.9	.151	40.5
1500.00	.025	−14.4	3.221	−44.2	.168	−101.4	.189	37.6
1600.00	.121	−13.2	3.136	−62.7	.166	−112.1	.236	27.3
1700.00	.239	−27.3	3.061	−83.8	.165	−124.3	.293	12.3
1800.00	.373	−40.5	2.830	−103.5	.156	−137.2	.349	−4.4
1900.00	.503	−57.6	2.492	−124.6	.144	−150.4	.393	−25.4
2000.00	.605	−72.5	2.102	−144.5	.127	−161.3	.421	−44.5

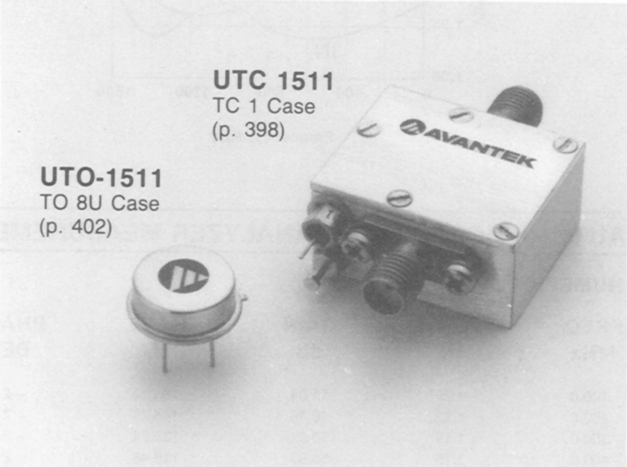
1511 Series

Thin Film Cascadable Amplifier
5-1500 MHz

AVANTEK

FEATURES

- **3.5 dB Noise Figure**

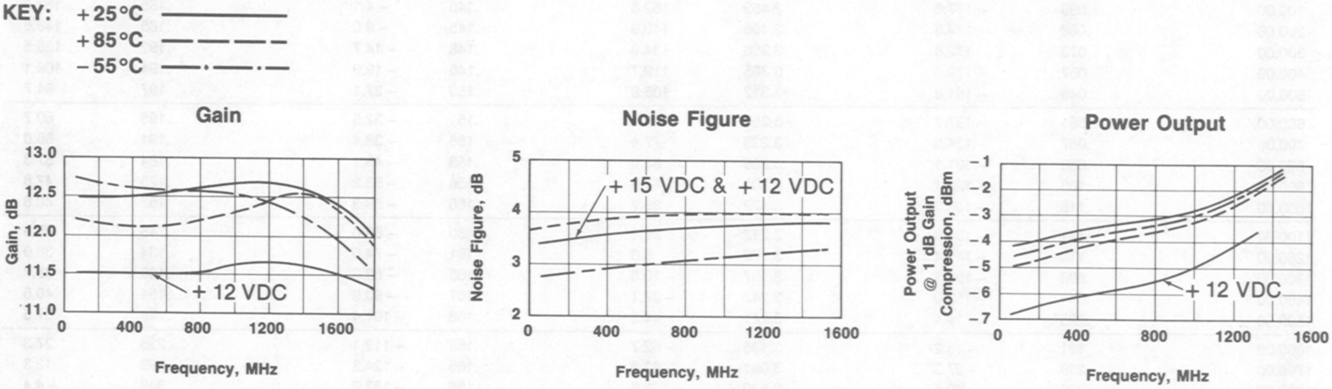

UTC 1511
TC 1 Case
(p. 398)

UTO-1511
TO 8U Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless noted otherwise)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$-$50°C$	Guaranteed Specifications $T_C = -55°$- $+85°C$	Unit
BW	Frequency Range	5-1500	5-1500	5-1500	MHz
GP	Small Signal Gain	12.5	10.0 Min.	10 Min.	dB
—	Gain Flatness	±0.5	±0.5 Max.	±1.0 Max.	dB
NF	Noise Figure	3.5	4.5 Max.	5.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	−4.0	−9.0 Min.	−10.0 Min.	dBm
—	Input VSWR	<1.7:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.7:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+1.0	—	—	dBm
I_D	DC Current	7	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)



MAXIMUM RATINGS

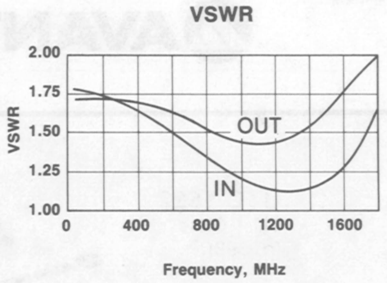
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 165°C/W
Active Transistor Power Dissipation .... 43 mW
Junction Temperature Above Case Temperature .... 7°C
MTBF .... 878,007 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.32	13.29	164.19	– 2.75	– 1.70	—	1.33	18.08
200.0	1.31	13.42	147.04	– 3.44	– 2.61	.40	1.36	18.08
300.0	1.30	13.31	132.72	– 1.33	– .72	.41	1.39	18.12
400.0	1.28	13.19	117.31	– .30	.08	.44	1.42	18.27
500.0	1.26	13.19	101.45	.28	.45	.43	1.45	18.23
600.0	1.26	13.09	85.88	1.14	1.09	.45	1.48	18.43
700.0	1.25	13.18	70.14	1.84	1.57	.43	1.46	18.77
800.0	1.26	13.21	54.56	2.70	2.20	.44	1.44	18.89
900.0	1.29	13.21	38.15	2.72	2.00	.47	1.44	19.12
1000.0	1.34	13.31	21.65	2.65	1.71	.45	1.41	19.31
1100.0	1.41	13.34	4.29	1.72	.56	.48	1.40	19.56
1200.0	1.51	13.50	– 12.07	1.78	.40	.45	1.39	19.96
1300.0	1.58	13.52	– 28.52	1.77	.16	.48	1.40	20.28
1400.0	1.67	13.40	– 46.35	.37	– 1.44	.53	1.40	20.58
1500.0	1.75	13.21	– 66.43	– 3.26	– 5.31	.57	1.39	20.91
1600.0	1.89	13.06	– 88.23	– 8.62	—	.58	1.37	20.87
1700.0	2.11	12.76	– 108.05	—	—	.56	1.33	20.98
1800.0	2.39	12.16	– 128.34	—	—	.58	1.27	21.14
1900.0	2.85	11.35	– 150.53	—	—	.00	1.21	21.41
LINEARIZATION RANGE:				100.0 TO 1600.0	100.0 TO 1500.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
100.00	.130	171.2	4.052	162.7	.140	– 4.7	.147	158.7
200.00	.125	162.1	4.008	150.0	.139	– 10.9	.150	138.9
300.00	.117	150.7	4.006	134.8	.141	– 17.5	.158	118.6
400.00	.104	139.8	3.952	119.4	.137	– 23.4	.161	99.8
500.00	.090	127.7	4.007	105.6	.139	– 31.1	.163	83.1
600.00	.072	115.8	3.992	91.5	.137	– 37.2	.158	66.4
700.00	.053	98.9	4.023	76.4	.138	– 43.3	.152	49.1
800.00	.031	77.0	4.037	62.4	.134	– 50.4	.136	33.5
900.00	.017	24.8	4.089	46.6	.133	– 58.3	.119	15.4
1000.00	.021	– 58.9	4.112	31.9	.133	– 64.5	.095	– 7.1
1100.00	.036	– 92.8	4.216	16.2	.129	– 71.1	.073	– 34.1
1200.00	.049	– 120.5	4.186	.9	.126	– 77.9	.058	– 76.1
1300.00	.060	– 150.7	4.243	– 16.9	.124	– 86.7	.065	– 125.8
1400.00	.068	176.6	4.308	– 33.4	.121	– 91.7	.087	– 159.2
1500.00	.086	136.6	4.257	– 50.8	.118	– 98.6	.113	175.4
1600.00	.125	99.7	4.162	– 69.2	.114	– 104.5	.133	157.9
1700.00	.187	67.8	4.100	– 89.3	.114	– 112.7	.143	141.8
1800.00	.271	42.6	3.874	– 107.7	.112	– 120.7	.142	129.0
1900.00	.361	20.9	3.586	– 128.2	.110	– 129.1	.128	120.7
2000.00	.456	.2	3.257	– 147.6	.106	– 137.7	.105	120.8

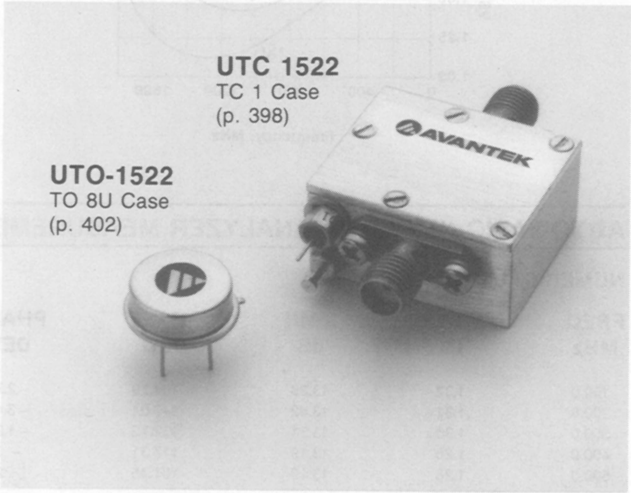
1522 Series

Thin Film Cascadable Amplifier
5-1500 MHz

AVANTEK

FEATURES

- **20.0 dB Gain**
- **+13.0 dBm Power Output**



UTC 1522
TC 1 Case
(p. 398)

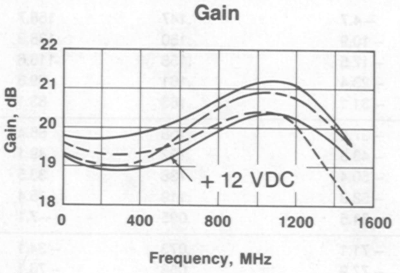
UTO-1522
TO 8U Case
(p. 402)

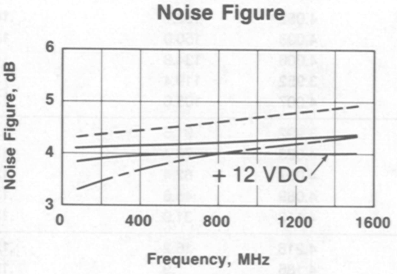
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

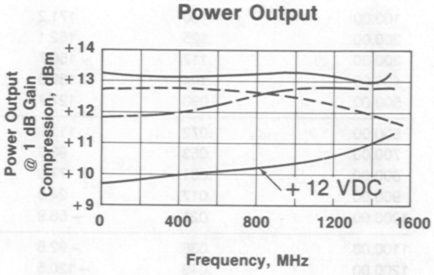
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = -55°- +85°C	Unit
BW	Frequency Range	5-1500	5-1500	5-1500	MHz
GP	Small Signal Gain	20.0	18.0 Min.	17.0 Min.	dB
—	Gain Flatness	±0.8	±1.5 Max.	±1.5 Max.	dB
NF	Noise Figure	4.5	5.5 Max.	6.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+13.0	+11.0 Min.	+10.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+23.0	—	—	dBm
I_D	DC Current	85	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

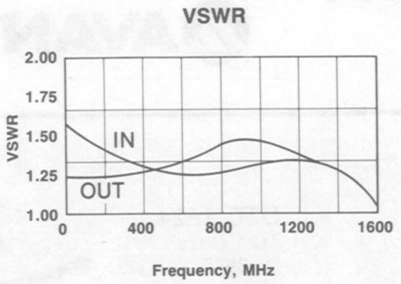
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +100°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 120/110°C/W
Active Transistor Power Dissipation .... 187/460 mW
Junction Temperature Above Case Temperature .... 22/50°C
MTBF .... 621,388 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.64	20.92	– 18.52	– 4.62	.00	1.29	36.97
150.0	1.64	20.93	– 27.57	– 4.03	.47	1.29	36.44
200.0	1.66	20.90	– 35.58	– 2.40	.47	1.30	36.29
250.0	1.66	20.81	– 44.65	– 1.83	.50	1.31	36.42
300.0	1.67	20.84	– 53.69	– 1.22	.50	1.32	36.39
350.0	1.65	20.87	– 62.69	– .57	.50	1.32	36.65
400.0	1.65	20.95	– 71.51	.25	.51	1.33	36.59
450.0	1.63	21.09	– 81.10	.30	.51	1.34	36.57
500.0	1.60	21.22	– 89.82	1.21	.49	1.36	36.74
600.0	1.54	21.38	– 107.92	2.39	.52	1.39	37.16
700.0	1.46	21.47	– 126.90	2.69	.55	1.43	37.43
800.0	1.39	21.38	– 146.77	2.12	.54	1.48	37.86
900.0	1.34	21.28	– 166.58	1.58	.54	1.52	38.81
1000.0	1.35	21.29	174.38	1.83	.54	1.54	39.98
1100.0	1.42	21.52	155.44	2.18	.53	1.52	41.44
1200.0	1.51	21.56	135.50	1.53	.59	1.43	41.94
1300.0	1.50	21.37	113.44	– 1.24	.61	1.32	41.77
1400.0	1.43	20.83	91.85	– 3.54	.58	1.25	41.86
1500.0	1.38	20.21	71.23	– 4.87	.57	1.20	42.13
1600.0	1.43	19.66	50.56	—	.58	1.16	42.29
1700.0	1.52	19.01	30.82	—	.53	1.15	42.92
1800.0	1.57	17.98	12.32	—	.50	1.17	43.04
1900.0	1.59	16.94	– 5.02	—	.46	1.20	42.17
2000.0	1.60	15.99	– 20.87	—	.00	1.24	41.43

LINEARIZATION RANGE: 100.0 TO 1500.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.244	154.3	20.700	– 18.2	– 35.509	– 1.9	.157	173.4
200.00	.250	137.0	20.669	– 35.4	– 35.329	– 11.0	.165	170.5
300.00	.250	121.9	20.597	– 53.1	– 36.050	– 18.0	.176	164.4
400.00	.250	107.9	20.719	– 70.4	– 36.091	– 26.4	.184	155.3
500.00	.240	93.5	21.057	– 88.4	– 36.082	– 33.3	.196	143.8
600.00	.218	76.2	21.280	– 106.5	– 36.594	– 43.9	.211	130.4
700.00	.187	53.5	21.450	– 125.4	– 37.182	– 52.2	.229	117.0
800.00	.160	23.9	21.441	– 145.4	– 37.887	– 62.0	.248	103.8
900.00	.147	– 10.7	21.388	– 165.7	– 38.653	– 69.7	.265	91.7
1000.00	.157	– 41.1	21.423	174.7	– 39.998	– 76.0	.274	80.3
1100.00	.179	– 67.5	21.695	155.6	– 41.777	– 82.5	.266	66.4
1200.00	.199	– 95.4	21.718	135.4	– 42.936	– 78.1	.238	51.3
1300.00	.188	– 126.4	21.517	112.8	– 42.193	– 76.0	.196	36.5
1400.00	.154	– 159.9	20.896	90.7	– 40.949	– 79.5	.158	22.7
1500.00	.130	160.2	20.249	70.3	– 41.216	– 88.3	.140	6.9
1600.00	.135	116.5	19.649	49.9	– 41.271	– 99.1	.134	– 9.3
1700.00	.162	82.5	19.023	30.7	– 41.843	– 100.5	.142	– 24.5
1800.00	.187	58.9	18.102	12.8	– 41.828	– 106.2	.163	– 38.9
1900.00	.205	42.0	17.196	– 4.9	– 42.248	– 109.0	.185	– 52.3
2000.00	.219	29.0	16.360	– 21.4	– 42.362	– 109.6	.205	– 66.2

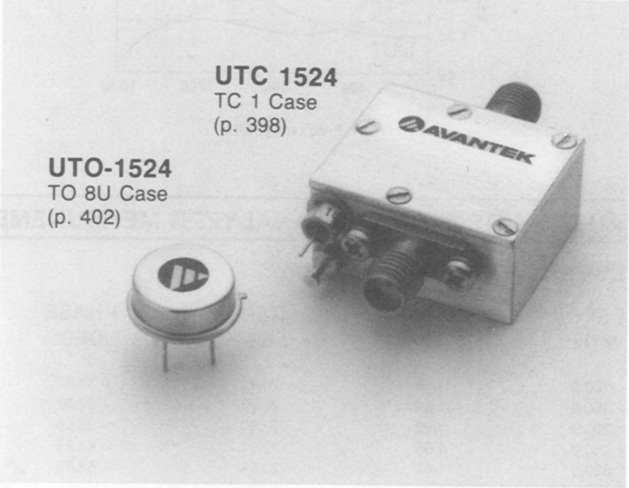
1524 Series

Thin Film Cascadable Amplifier
10-1500 MHz

AVANTEK

FEATURES

- **22.0 dB Gain**
- **+9.0 dBm Output Power**



UTC 1524
TC 1 Case
(p. 398)

UTO-1524
TO 8U Case
(p. 402)

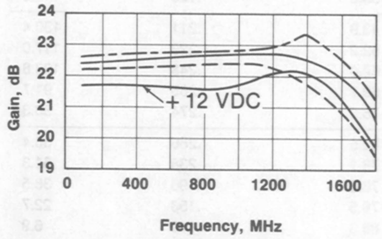
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	10-1500	10-1500	10-1500	MHz
GP	Small Signal Gain	22.0	21.0 Min.	20.0 Min.	dB
—	Gain Flatness	±0.4	±1.5 Max.	±1.5 Max.	dB
NF	Noise Figure	4.0	4.5 Max.	5.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+9.0	+7.0 Min.	+6.0 Min.	dBm
—	Input VSWR	—	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	—	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+19.0	—	—	dBm
I_D	DC Current	60	—	—	mA

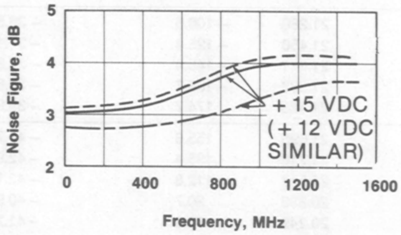
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
−55°C —·—·—

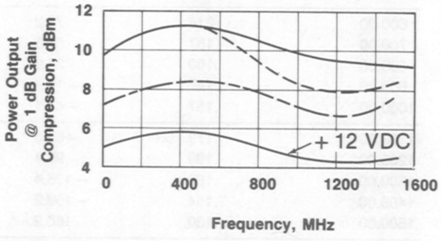
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

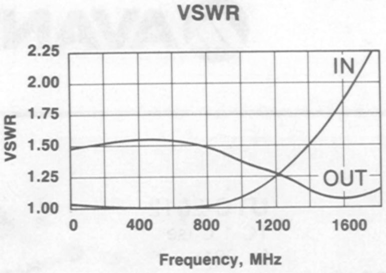
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +115°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +115°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 120/110°C/W
Active Transistor Power Dissipation .... 102/340 mW
Junction Temperature Above Case Temperature ...... 12/37°C
MTBF .... 620,497 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.01	22.53	–15.01	–3.10	.00	1.58	36.39
200.0	1.02	22.48	–30.29	–2.39	.44	1.57	35.33
300.0	1.03	22.54	45.95	–2.02	.42	1.56	36.49
400.0	1.03	22.61	–60.93	–.99	.39	1.56	36.32
500.00	1.04	22.52	–74.88	1.07	.39	1.55	36.61
600.0	1.05	22.47	–89.61	2.35	.45	1.53	37.27
700.0	1.07	22.47	–105.97	2.00	.46	1.50	37.75
800.0	1.10	22.61	–122.32	1.66	.46	1.45	38.40
900.0	1.14	22.80	–138.12	1.85	.41	1.38	38.91
1000.0	1.18	22.80	–153.28	2.71	.43	1.30	39.35
1100.0	1.24	22.86	–169.08	2.91	.46	1.21	39.71
1200.0	1.30	22.84	173.66	1.66	.50	1.13	41.39
1300.0	1.37	22.79	155.74	–.23	.52	1.06	41.92
1400.0	1.48	22.85	136.39	–3.56	.52	1.00	43.37
1500.0	1.64	22.62	117.14	–6.80	.56	1.02	44.35

LINEARIZATION RANGE: 100.0 TO 1500.0

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.019	–174.1	22.562	–15.2	–34.760	8.0	.226	172.6
200.00	.028	–124.8	22.576	–30.1	–35.860	.7	.222	169.1
300.00	.036	–116.0	22.522	–45.1	–35.616	–14.3	.219	161.8
400.00	.039	–108.4	22.496	–60.4	–35.936	–17.4	.219	155.1
500.00	.040	–95.5	22.486	–75.9	–36.753	–19.9	.215	147.4
600.00	.045	–86.1	22.593	–91.1	–36.615	–26.9	.207	140.0
700.00	.053	–78.8	22.690	–106.5	–37.868	–31.7	.195	130.8
800.00	.065	–82.3	22.812	–122.0	–38.339	–35.4	.178	121.8
900.00	.075	–91.4	22.902	–137.1	–38.262	–41.2	.156	109.7
1000.00	.085	–110.6	22.924	–153.1	–39.934	–39.0	.130	98.6
1100.00	.098	–135.6	22.974	–169.1	–40.571	–43.4	.098	84.6
1200.00	.121	–165.5	23.002	174.1	–41.071	–49.8	.064	71.3
1300.00	.154	164.4	23.033	156.4	–42.089	–52.1	.034	58.2
1400.00	.205	137.1	22.926	137.4	–42.274	–52.9	.007	87.3
1500.00	.264	109.5	22.734	117.8	–44.008	–65.3	.018	146.9
1600.00	.323	82.4	22.295	97.4	–46.629	–60.4	.026	109.8
1700.00	.372	56.6	21.600	77.3	–51.695	–32.0	.030	44.7
1800.00	.412	32.4	20.622	58.9	–45.624	–4.4	.050	–22.0

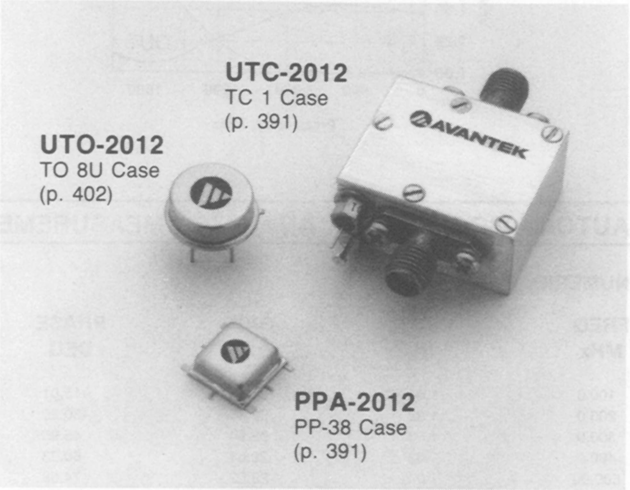
2012 Series

Thin Film Cascadable Amplifier 500-2000 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **3.0 dB Noise Figure**
- **GaAs FET**


UTC-2012
TC 1 Case
(p. 391)

UTO-2012
TO 8U Case
(p. 402)

PPA-2012
PP-38 Case
(p. 391)

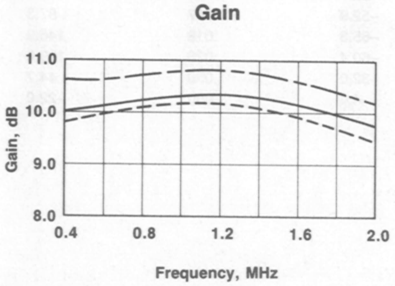
ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

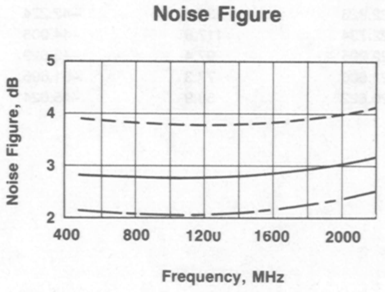
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	500-2000	500-2000	500-2000	MHz
GP	Small Signal Gain	10.0	9.0 Min.	8.5 Min.	dB
—	Gain Flatness	±0.3	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	3.0	4.0 Max.	4.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+13.0	+12.0 Min.	+11.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+23.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+33.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+39.0	—	—	dBm
I_D	DC Current	50	—	—	mA

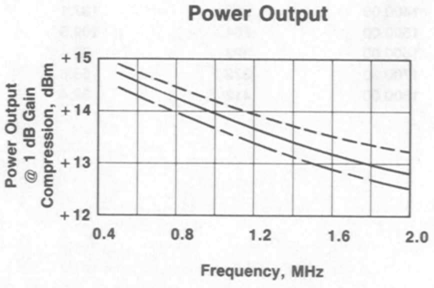
NOTE 1: RF input pin is at DC ground — no input blocking capacitor.

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ———
+85°C — — —
−55°C —·—·—


Gain


Noise Figure


Power Output

MAXIMUM RATINGS

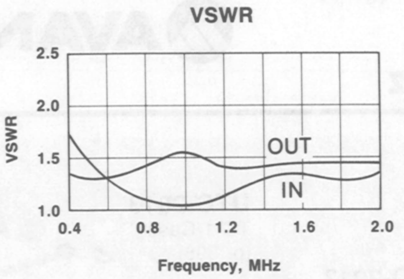
DC Voltage	+17 Volts
Continuous RF Input Power	+15 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

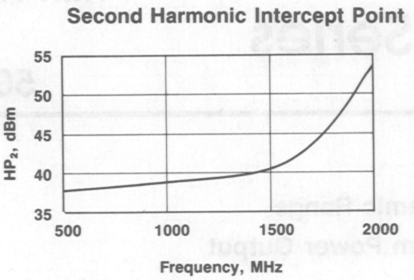
THERMAL CHARACTERISTICS*

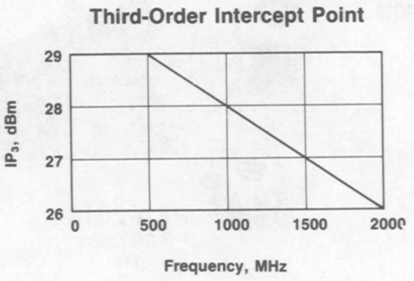
θ_{JC}	60°C/W
Active Transistor Power Dissipation	540 mW
Junction Temperature Above Case Temperature	32°C
MTBF	538,295 Hrs.

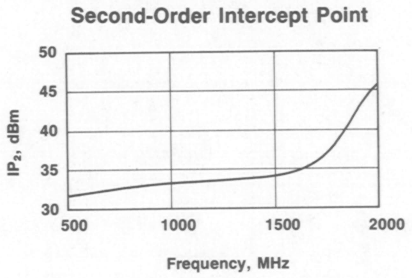
*For further information, see High Reliability section.

WEIGHT: (typical) PPA — 0.5 grams; UTO — 2.1 grams; UTC — 21.5 grams









AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
500.0	1.32	10.66	170.30	9.46	.57	1.41	16.35
600.0	1.20	10.65	151.64	3.72	.49	1.45	16.60
700.0	1.11	10.59	134.99	–.02	.44	1.51	16.84
800.0	1.03	10.59	119.69	–2.41	.40	1.56	17.02
900.0	1.03	10.57	105.49	–3.71	.39	1.61	17.15
1000.0	1.06	10.67	92.93	–3.37	.33	1.62	17.34
1100.0	1.05	10.57	81.00	–2.40	.34	1.55	17.48
1200.0	1.05	10.54	68.30	–2.21	.34	1.46	17.57
1300.0	1.05	10.51	56.10	–1.51	.34	1.36	17.48
1400.0	1.06	10.49	43.58	–1.13	.34	1.30	17.46
1500.0	1.06	10.48	31.45	–.37	.35	1.30	17.44
1600.0	1.04	10.57	18.63	–.28	.33	1.35	17.35
1700.0	1.05	10.55	7.26	1.24	.33	1.44	17.36
1800.0	1.10	10.44	–5.17	1.71	.33	1.50	17.35
1900.0	1.15	10.44	–17.67	2.12	.36	1.47	17.40
2000.0	1.19	10.35	–30.49	2.19	.36	1.36	17.37

LINEARIZATION RANGE: 500.0 TO 2000.0

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
500.00	.077	–21.4	10.225	172.3	–16.048	–27.4	.145	–129.7
600.00	.047	–6.7	10.208	152.5	–16.347	–39.1	.167	–155.5
700.00	.021	–17.1	10.256	136.3	–16.996	–51.0	.175	–179.4
800.00	.005	–162.4	10.250	120.6	–17.395	–62.1	.181	164.4
900.00	.028	–146.3	10.342	105.9	–17.191	–74.7	.202	148.8
1000.00	.016	128.8	10.366	93.5	–17.447	–86.4	.213	136.1
1100.00	.013	29.1	10.281	80.8	–18.202	–98.1	.189	130.2
1200.00	.030	–15.7	10.203	67.6	–17.753	–110.3	.172	118.9
1300.00	.056	–31.8	10.218	54.3	–17.535	–120.5	.133	112.4
1400.00	.046	–50.1	10.320	41.3	–17.343	–132.6	.098	98.8
1500.00	.034	–75.0	10.310	28.1	–17.653	–143.1	.079	68.0
1600.00	.020	75.8	10.573	15.8	–17.464	–158.5	.088	36.1
1700.00	.066	63.7	10.470	2.5	–17.371	–169.5	.119	10.7
1800.00	.111	80.6	10.448	–11.6	–17.828	176.7	.102	11.4
1900.00	.136	78.5	10.362	–26.9	–18.291	163.0	.202	29.2
2000.00	.103	81.1	10.227	–40.9	–17.434	149.7	.233	62.2

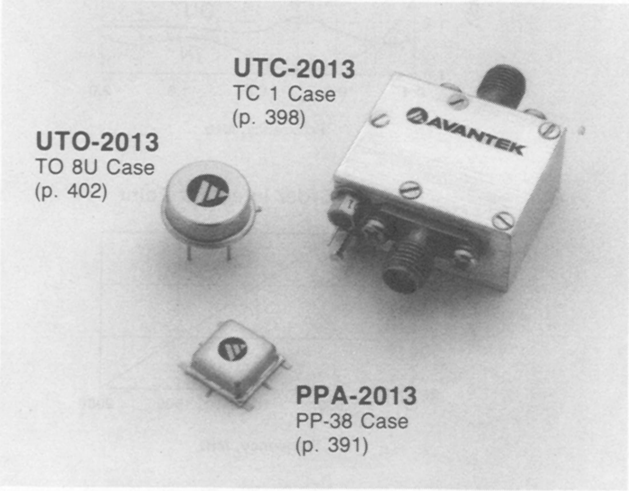
2013 Series

Thin Film Cascadable Amplifier 500-2000 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **+21.0 dBm Power Output**
- **GaAs FET**



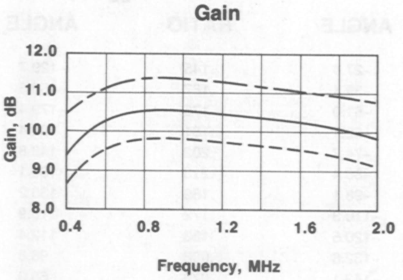
ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

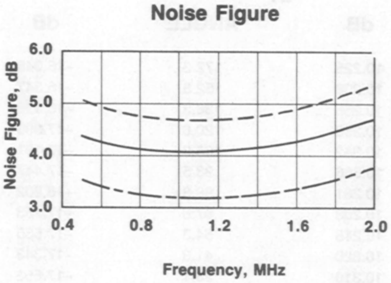
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = -55°- +85°C	Unit
BW	Frequency Range	500-2000	500-2000	500-2000	MHz
GP	Small Signal Gain	10.0	9.0 Min.	8.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.5	5.5 Max.	6.0 Max.	dB
$P_{1 dB}$	Power Output @ +1 dB Compression	+21.0	+19.0 Min.	+18.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+33.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+37.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+43.0	—	—	dBm
I_D	DC Current	100	—	—	mA

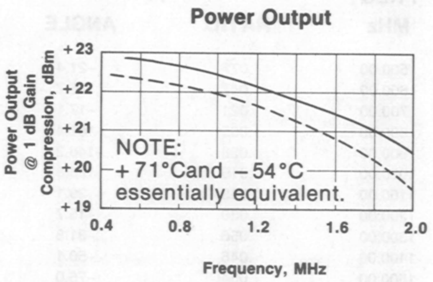
NOTE 1: RF input pin is at DC ground — no input blocking capacitor.

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—·







MAXIMUM RATINGS

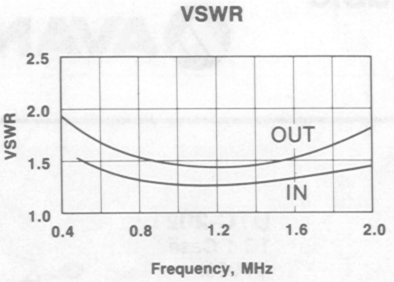
DC Voltage .... +17 Volts
Continuous RF Input Power .... +17 dBm
Operating Case Temperature .... −55°C to +85°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +85°C

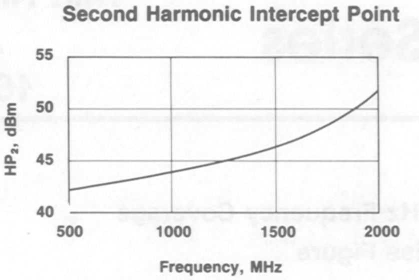
THERMAL CHARACTERISTICS*

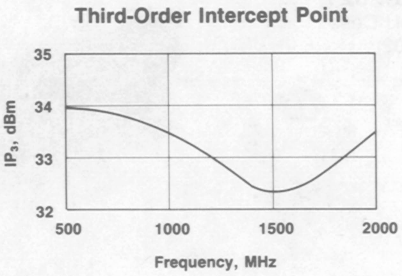
θ_{JC} .... 60°C/W
Active Transistor Power Dissipation .... 1140 mW
Junction Temperature Above Case Temperature .... 68°C
MTBF .... 517,385 Hrs.

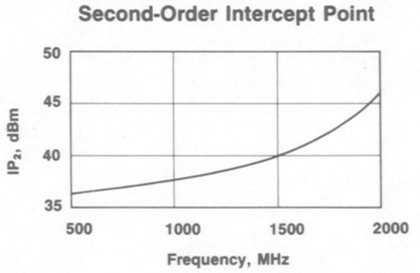
*For further information, see High Reliability section.

WEIGHT: (typical) PPA — 0.5 grams; UTO — 2.1 grams; UTC — 21.5 grams









AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit @ +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
400.0	1.58	9.54	−160.92	–	.92	1.39	15.90
500.0	1.28	9.91	170.88	10.08	.69	1.36	16.01
600.0	1.15	10.02	148.57	3.28	.57	1.38	16.14
700.0	1.08	10.03	128.97	−.80	.52	1.42	16.35
800.0	1.09	10.04	111.27	−2.97	.47	1.44	16.53
900.0	1.11	10.13	94.80	−3.92	.43	1.46	16.68
1000.0	1.11	10.20	80.09	−3.11	.40	1.44	16.90
1100.0	1.07	10.20	65.49	−2.18	.42	1.39	17.03
1200.0	1.06	10.18	50.46	−1.70	.41	1.34	17.07
1300.0	1.07	10.15	35.55	−1.08	.42	1.32	17.01
1400.0	1.07	10.19	20.43	−.68	.41	1.32	17.02
1500.0	1.04	10.19	5.46	−.13	.43	1.38	17.00
1600.0	1.06	10.30	−9.46	.45	.39	1.51	17.05
1700.0	1.14	10.23	−23.97	1.46	.42	1.65	17.16
1800.0	1.24	10.16	−38.70	2.24	.43	1.74	17.32
1900.0	1.32	10.12	−55.02	1.45	.45	1.72	17.35
2000.0	1.40	10.21	−71.49	.51	.46	1.68	17.43
2100.0	1.44	10.29	−88.92	–	.52	1.66	17.28

LINEARIZATION RANGE: 500.0 TO 2000.0

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
500.00	.199	32.7	10.097	178.2	−17.058	−14.6	.130	−72.6
600.00	.125	19.7	10.257	154.3	−16.560	−29.8	.111	−108.7
700.00	.069	−14.2	10.299	135.3	−16.848	−48.7	.094	−154.8
800.00	.053	−69.5	10.268	117.2	−17.316	−61.4	.093	166.5
900.00	.078	−111.6	10.385	100.5	−17.040	−77.9	.120	145.9
1000.00	.069	−111.9	10.375	86.4	−17.402	−91.4	.114	139.3
1100.00	.103	−109.0	10.296	71.4	−18.034	−105.3	.094	146.7
1200.00	.115	−116.0	10.205	56.0	−17.977	−119.2	.071	146.7
1300.00	.116	−120.1	10.078	40.9	−17.625	−131.8	.048	172.7
1400.00	.111	−135.0	10.045	26.8	−17.854	−143.2	.040	−171.3
1500.00	.098	−144.1	10.015	12.8	−18.129	−156.0	.025	−170.5
1600.00	.071	179.8	10.159	−.1	−17.931	−170.3	.018	115.7
1700.00	.068	134.5	10.142	−14.9	−17.947	177.3	.019	64.0
1800.00	.072	93.3	10.156	−30.8	−18.386	158.1	.013	−38.3
1900.00	.095	66.8	10.091	−47.6	−18.220	145.4	.032	−54.2
2000.00	.110	46.5	9.907	−63.4	−18.194	132.1	.068	−88.7

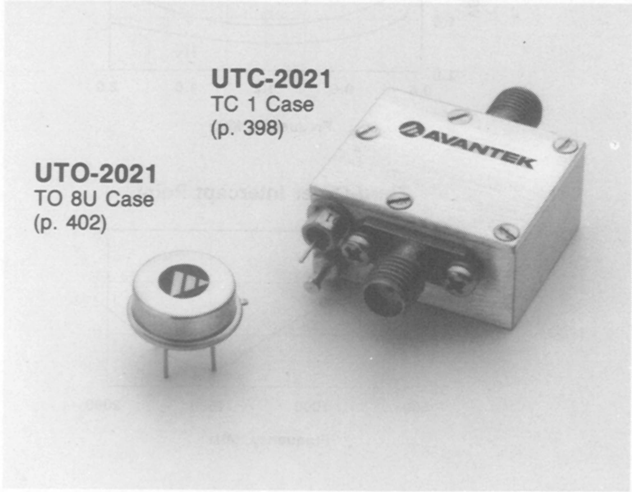
2021 Series

Thin Film Cascadable Amplifier 10-2000 MHz

AVANTEK

FEATURES

- **10-2000 MHz Frequency Coverage**
- **4.0 dB Noise Figure**



UTC-2021
TC 1 Case
(p. 398)

UTO-2021
TO 8U Case
(p. 402)

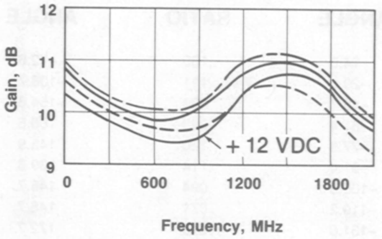
ELECTRICAL SPECIFICATIONS[1] (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°-50°C$	$T_C = -55°- +85°C$	Unit
BW	Frequency Range	10-2000	10-2000	10-2000	MHz
GP	Small Signal Gain	10.0	9.0 Min.	8.5 Min.	dB
—	Gain Flatness	±0.7	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	3.7	4.5 Max.	5.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+4.0	+2.0 Min.	+2.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+14.0	—	—	dBm
I_D	DC Current	16	—	—	mA

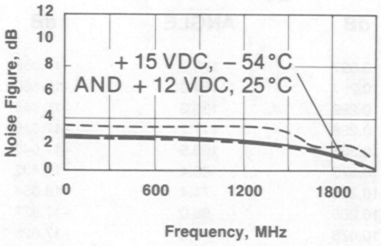
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—

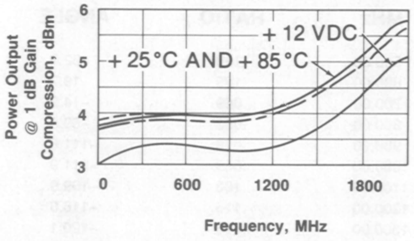
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

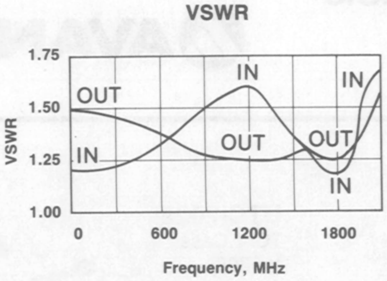
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	165°C/W
Active Transistor Power Dissipation	126 mW
Junction Temperature Above Case Temperature	21°C
MTBF	722,789 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.19	11.26	166.23	–6.03	.00	1.49	18.82
200.0	1.21	11.18	153.28	–5.27	.36	1.46	18.88
300.0	1.23	11.09	140.08	–4.74	.36	1.43	18.92
400.0	1.27	11.08	127.41	–3.69	.34	1.41	19.00
500.0	1.31	11.06	115.25	–2.14	.33	1.38	19.03
600.0	1.36	11.00	103.46	–.23	.33	1.35	19.08
700.0	1.42	10.96	91.63	1.64	.31	1.32	19.13
800.0	1.48	10.98	80.57	4.29	.33	1.30	19.20
900.0	1.54	11.04	68.43	5.88	.35	1.28	19.27
1000.0	1.59	11.14	55.49	6.63	.37	1.27	19.41
1100.0	1.61	11.31	41.97	6.81	.38	1.27	19.61
1200.0	1.60	11.44	27.77	6.31	.40	1.28	19.81
1300.0	1.55	11.50	12.82	5.07	.43	1.28	20.01
1400.0	1.47	11.53	–2.70	3.26	.43	1.29	20.08
1500.0	1.38	11.42	–18.15	1.53	.43	1.29	19.97
1600.0	1.29	11.24	–33.69	–.29	.44	1.28	19.77
1700.0	1.22	11.05	–49.74	–2.63	.44	1.25	19.50
1800.0	1.19	10.89	–65.46	–4.62	.44	1.24	19.23
1900.0	1.25	10.69	–81.19	–6.63	.45	1.25	18.93
2000.0	1.41	10.35	–97.89	–9.62	.48	1.35	18.78
2100.0	1.70	9.89	–115.76	–	.51	1.52	18.67
2200.0	2.15	9.24	–134.59	–	.54	1.76	18.82

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.088	–171.5	11.224	166.2	–18.937	–6.7	.191	166.7
200.00	.094	–162.9	11.157	153.0	–18.895	–13.7	.188	154.2
300.00	.104	–156.4	11.064	139.8	–19.000	–20.3	.179	141.5
400.00	.117	–151.1	11.057	126.8	–19.069	–26.6	.172	129.2
500.00	.136	–149.1	11.036	114.7	–19.059	–33.7	.162	119.0
600.00	.157	–148.2	10.993	102.7	–19.064	–40.5	.151	108.4
700.00	.183	–150.3	10.979	90.8	–19.144	–48.0	.137	98.6
800.00	.207	–154.1	10.988	79.5	–19.215	–54.7	.126	88.4
900.00	.231	–160.5	11.062	67.3	–19.276	–60.7	.115	77.5
1000.00	.252	–167.2	11.177	54.3	–19.411	–67.6	.107	64.1
1100.00	.261	–175.4	11.352	40.6	–19.593	–74.6	.104	48.3
1200.00	.259	175.7	11.502	26.3	–19.812	–81.1	.105	29.3
1300.00	.243	165.6	11.616	11.1	–19.975	–86.7	.110	9.7
1400.00	.210	154.9	11.659	–4.6	–20.031	–92.5	.116	–10.1
1500.00	.171	144.0	11.544	–20.4	–19.874	–98.0	.119	–26.6
1600.00	.124	130.1	11.363	–36.1	–19.667	–104.0	.120	–39.2
1700.00	.080	104.0	11.174	–52.5	–19.411	–110.1	.118	–44.2
1800.00	.061	46.4	11.033	–68.6	–19.136	–117.3	.117	–41.6
1900.00	.108	–4.8	10.797	–84.6	–18.878	–125.9	.133	–34.1
2000.00	.192	–28.7	10.450	–101.6	–18.706	–135.7	.171	–29.2
2100.00	.299	–44.6	9.950	–119.5	–18.655	–146.5	.230	–31.7
2200.00	.415	–58.7	9.272	–138.4	–18.784	–158.3	.296	–39.5
2300.00	.521	–72.7	8.307	–157.7	–19.149	–170.6	.350	–49.4
2400.00	.615	–85.5	7.085	–176.6	–19.758	178.5	.388	–60.3
2500.00	.689	–97.2	5.641	165.3	–20.423	167.3	.402	–70.3

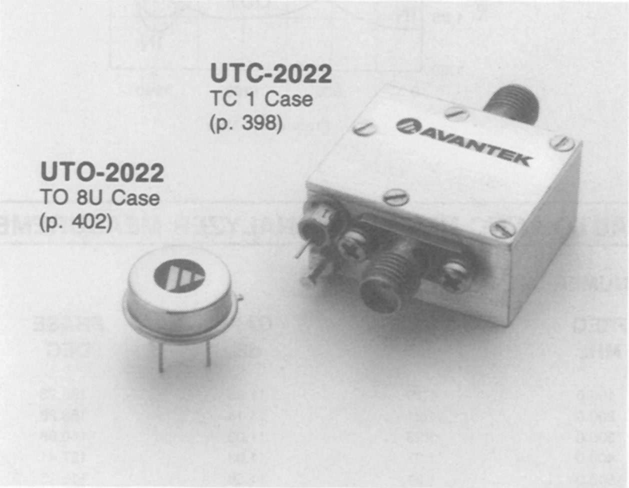
2022 Series

Thin Film Cascadable Amplifier 10-2000 MHz

AVANTEK

FEATURES

- **10-2000 MHz Frequency Coverage**



UTC-2022
TC 1 Case
(p. 398)

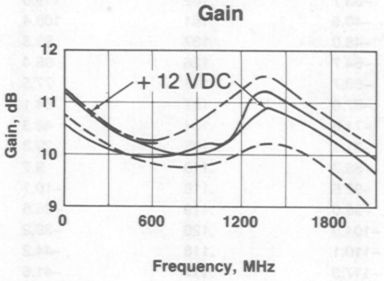
UTO-2022
TO 8U Case
(p. 402)

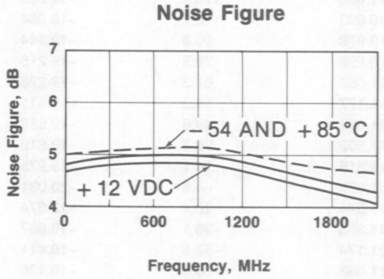
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

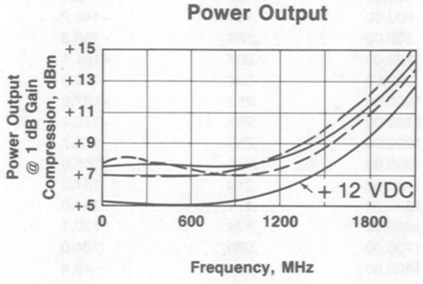
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications		Unit
			T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	10-2000	10-2000	10-2000	MHz
GP	Small Signal Gain	10.0	9.0 Min.	8.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	5.0	6.0 Max.	6.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+8.0	+7.0 Min.	+6.5 Min.	dBm
—	Input VSWR	<1.7:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+17.0	—	—	dBm
I_D	DC Current	25	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ———
+85°C — — —
−55°C —·—·—







MAXIMUM RATINGS

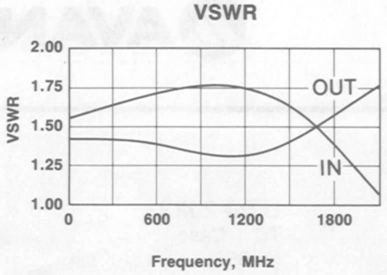
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +115°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +115°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 165°C/W
Active Transistor Power Dissipation .... 216 mW
Junction Temperature Above Case Temperature .... 36°C
MTBF .... 768,129 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.26	10.45	166.48	–7.64	.00	1.62	18.02
200.0	1.29	10.39	154.11	–6.19	.35	1.59	18.22
300.0	1.32	10.35	141.35	–5.12	.36	1.58	18.22
400.0	1.36	10.39	128.99	–3.66	.33	1.58	18.32
500.0	1.40	10.44	117.02	–1.80	.33	1.57	18.42
600.0	1.46	10.46	105.27	.25	.32	1.56	18.60
700.0	1.50	10.50	93.48	2.30	.31	1.55	18.69
800.0	1.56	10.57	82.37	5.01	.34	1.55	18.83
900.0	1.60	10.71	70.04	6.48	.35	1.55	19.00
1000.0	1.63	10.87	57.02	7.27	.37	1.55	19.24
1100.0	1.64	11.05	43.12	7.18	.39	1.56	19.50
1200.0	1.61	11.20	28.58	6.47	.41	1.56	19.76
1300.0	1.56	11.29	13.37	5.09	.43	1.55	19.95
1400.0	1.48	11.33	–2.31	3.23	.43	1.53	20.00
1500.0	1.40	11.26	–17.82	1.55	.43	1.48	19.84
1600.0	1.34	11.10	–33.49	–.28	.44	1.41	19.59
1700.0	1.29	10.95	–49.56	–2.52	.45	1.35	19.25
1800.0	1.31	10.89	–65.62	–4.75	.44	1.31	18.95
1900.0	1.38	10.76	–81.80	–7.11	.46	1.32	18.65
2000.0	1.55	10.46	–99.32	–10.81	.51	1.41	18.52
2100.0	1.86	10.00	–118.20	–	.54	1.57	18.44
2200.0	2.33	9.26	–138.11	–	.56	1.77	18.60

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.186	179.5	10.505	166.7	–18.576	–6.6	.268	166.3
200.00	.184	179.2	10.452	154.2	–18.519	–12.5	.261	153.2
300.00	.183	179.4	10.393	141.6	–18.585	–19.2	.254	139.8
400.00	.180	–179.5	10.405	129.1	–18.655	–25.5	.249	126.7
500.00	.185	–177.8	10.410	117.4	–18.645	–32.5	.239	115.3
600.00	.190	–175.8	10.410	105.9	–18.672	–39.2	.227	103.3
700.00	.204	–175.2	10.426	94.4	–18.801	–46.0	.212	91.3
800.00	.220	–175.7	10.456	83.7	–18.855	–52.7	.202	78.7
900.00	.239	–178.3	10.570	71.8	–18.982	–58.5	.190	65.0
1000.00	.257	178.2	10.723	59.5	–19.201	–64.8	.184	49.7
1100.00	.267	172.4	10.906	46.1	–19.411	–71.3	.183	32.4
1200.00	.268	165.7	11.096	32.3	–19.628	–76.8	.189	13.7
1300.00	.257	157.8	11.236	17.4	–19.762	–81.5	.199	–5.4
1400.00	.232	149.7	11.306	2.2	–19.845	–86.1	.209	–24.5
1500.00	.201	141.9	11.242	–13.1	–19.678	–91.0	.215	–42.0
1600.00	.165	134.8	11.088	–28.2	–19.386	–96.1	.213	–57.7
1700.00	.130	124.8	10.896	–43.7	–19.083	–101.6	.204	–69.8
1800.00	.096	109.6	10.809	–59.0	–18.775	–108.0	.184	–78.0
1900.00	.074	75.1	10.722	–73.9	–18.472	–114.9	.157	–80.1
2000.00	.085	23.5	10.576	–89.7	–18.191	–122.7	.132	–71.2
2100.00	.150	–12.3	10.340	–106.5	–17.919	–131.8	.139	–53.6
2200.00	.245	–34.2	10.002	–124.8	–17.733	–142.2	.188	–42.5
2300.00	.351	–51.3	9.410	–144.2	–17.726	–153.4	.257	–43.7
2400.00	.458	–67.1	8.497	–164.3	–17.862	–164.8	.327	–50.8
2500.00	.551	–81.4	7.273	176.0	–18.237	–176.1	.377	–59.9

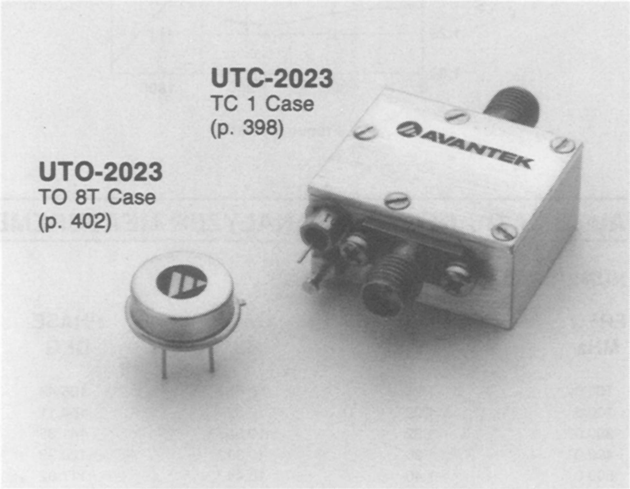
2023 Series

Thin Film Cascadable Amplifier 10-2000 MHz

AVANTEK

FEATURES

- **10-2000 MHz Frequency Coverage**
- **+16.0 dBm Output Power**



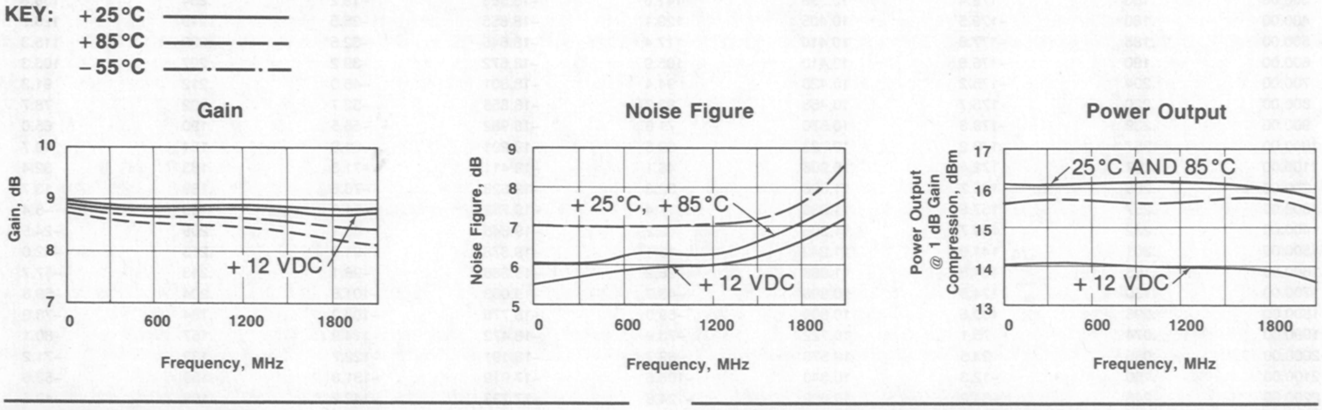
UTC-2023
TC 1 Case
(p. 398)

UTO-2023
TO 8T Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	Guaranteed Specifications $T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	10-2000	10-2000	10-2000	MHz
GP	Small Signal Gain	8.5	8.0 Min.	7.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	6.5	8.5 Max.	9.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+16.0	+14.0 Min.	+14.0 Min.	dBm
—	Input VSWR	<1.8:1	2.2:1 Max.	2.2:1 Max.	—
—	Output VSWR	<1.5:1	2.2:1 Max.	2.2:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+29.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+40.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+46.0	—	—dBm	
I_D	DC Current	50	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)



MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +85°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +85°C

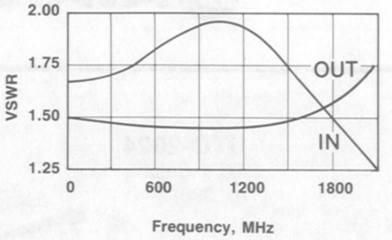
THERMAL CHARACTERISTICS*

θ_{JC} .... 110°C/W
Active Transistor Power Dissipation .... 600 mW
Junction Temperature Above Case Temperature .... 66°C
MTBF .... 857,646 Hrs.

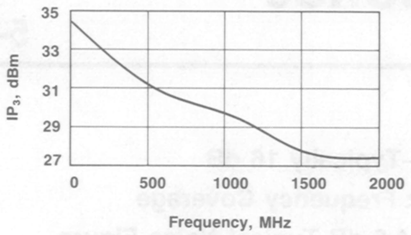
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

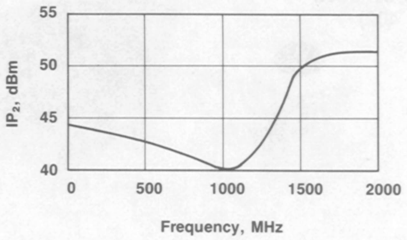
VSWR



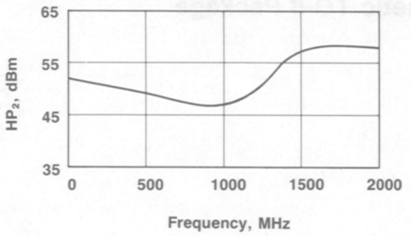
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.59	9.08	168.15	–1.16	.00	1.48	15.29
200.0	1.61	9.03	156.52	–1.27	.33	1.47	15.34
300.0	1.63	8.96	144.62	–1.67	.33	1.46	15.38
400.0	1.66	8.97	132.82	–1.96	.31	1.45	15.51
500.0	1.69	8.98	121.76	–1.51	.30	1.44	15.61
600.0	1.73	8.94	110.90	–.85	.30	1.42	15.72
700.0	1.75	8.86	100.15	–.10	.28	1.40	15.82
800.0	1.78	8.80	90.08	1.35	.31	1.37	15.92
900.0	1.78	8.75	79.14	1.92	.31	1.35	16.01
1000.0	1.79	8.71	68.05	2.34	.31	1.32	16.07
1200.0	1.76	8.67	45.08	2.40	.32	1.31	16.25
1400.0	1.69	8.63	21.55	1.91	.33	1.35	16.36
1600.0	1.58	8.65	–2.46	.94	.34	1.46	16.32
1800.0	1.43	8.59	–28.04	–1.60	.37	1.60	16.29
2000.0	1.23	8.56	–55.05	–5.57	.38	1.73	16.22
2200.0	1.14	8.14	–82.83	–	.40	1.79	16.21
2400.0	1.49	7.29	–112.71	–	.43	1.79	16.39

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.241	–178.1	8.611	168.7	–15.091	–6.1	.182	161.6
200.00	.242	–178.7	8.589	157.1	–15.207	–13.1	.179	147.1
300.00	.247	–179.7	8.543	145.5	–15.262	–19.4	.181	131.2
400.00	.250	179.3	8.575	133.8	–15.409	–25.3	.182	116.6
500.00	.258	178.0	8.614	122.9	–15.473	–31.7	.180	103.3
600.00	.263	176.9	8.613	112.3	–15.547	–38.0	.176	89.5
700.00	.272	175.1	8.621	101.7	–15.677	–44.3	.168	75.3
800.00	.277	172.8	8.619	91.6	–15.779	–50.1	.161	60.4
900.00	.282	170.3	8.630	80.7	–15.773	–55.0	.149	44.2
1000.00	.283	168.1	8.663	69.5	–15.849	–61.0	.139	25.0
1200.00	.275	162.2	8.758	46.2	–16.031	–73.1	.128	–18.9
1400.00	.249	154.1	8.886	22.2	–16.145	–85.6	.139	–85.7
1600.00	.200	143.2	9.013	–2.8	–16.116	–98.1	.167	–107.1
1800.00	.119	126.5	9.059	–29.8	–16.163	–110.6	.191	–143.6
2000.00	.026	27.6	9.063	–58.5	–16.245	–124.1	.209	–178.0
2200.00	.164	–60.6	8.539	–87.8	–16.442	–139.7	.219	144.2
2400.00	.330	–83.0	7.508	–118.7	–16.906	–156.7	.227	109.4

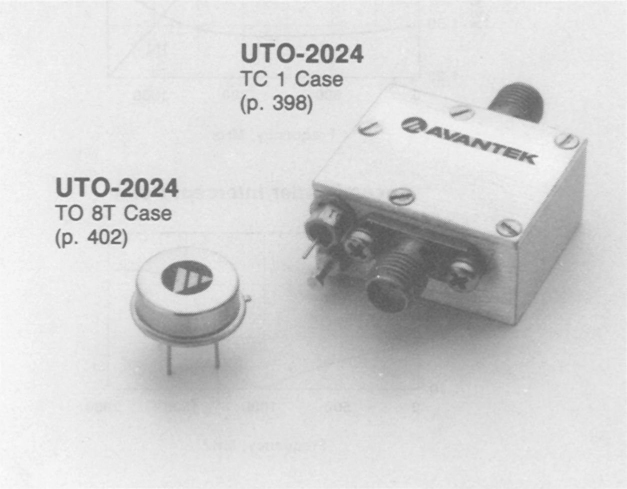
2024 Series

Thin Film Cascadable Amplifier
5-2000 MHz

AVANTEK

FEATURES

- **High Gain—Typically 16 dB**
- **5-2000 MHz Frequency Coverage**
- **Less Than 4.6 dB Typical Noise Figure**
- **Reliable Thin-Film Construction**
- **Small Hermetic TO-8 Package**



UTO-2024
TC 1 Case
(p. 398)

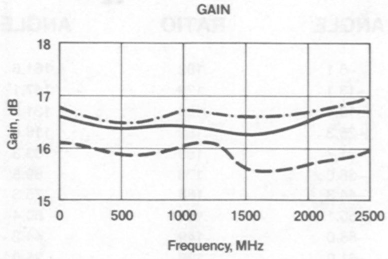
UTO-2024
TO 8T Case
(p. 402)

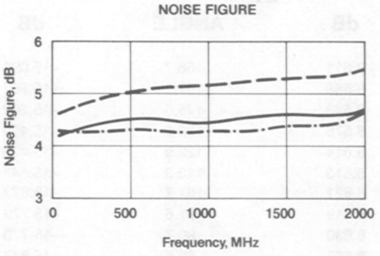
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

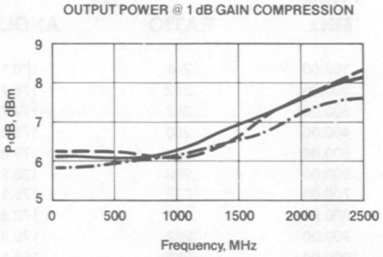
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	5-2000	5-2000	5-2000	MHz
GP	Small Signal Gain	16.0	15.0 Min.	14.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.5	5.5 Max.	6.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+6.0	+5.0 Min.	+4.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.8:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+18.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+30.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+40.0	—	—	dBm
I_D	DC Current	38	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

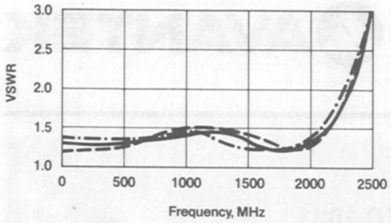
THERMAL CHARACTERISTICS*

θ_{JC} .... 105/90°C/W
Active Transistor Power Dissipation .... 85/130 mW
Junction Temperature Above Case Temperature ..... 9/12°C
MTBF .... 890,224 Hrs.

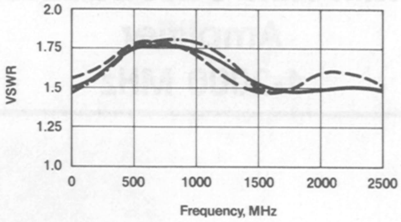
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

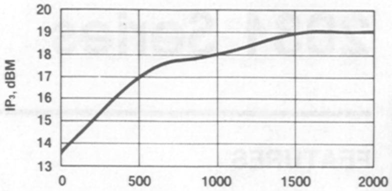
INPUT VSWR



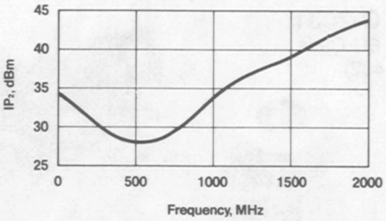
OUTPUT VSWR



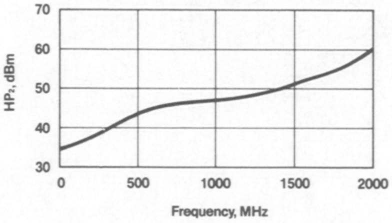
THIRD ORDER INTERCEPT POINT



SECOND ORDER INTERCEPT POINT



SECOND HARMONIC INTERCEPT POINT



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEVIATION	GROUP DELAY NSEC	VSWR OUT	ISOLATION dB
100.0	1.22	16.54	−10.39	−2.14	.00	1.51	30.62
200.0	1.22	16.46	−17.84	−.46	.22	1.55	30.48
300.0	1.22	16.29	−26.31	.19	.25	1.61	30.69
400.0	1.24	16.28	−35.94	−.29	.26	1.68	30.96
500.0	1.26	16.35	−44.87	−.08	.25	1.75	31.27
600.0	1.29	16.50	−53.95	−.02	.27	1.80	31.37
700.0	1.34	16.54	−64.05	−.99	.25	1.84	31.53
800.0	1.37	16.46	−72.05	.14	.23	1.88	31.81
900.0	1.40	16.50	−80.69	.62	.25	1.84	32.04
1000.0	1.43	16.51	−89.75	.70	.23	1.76	32.32
1100.0	1.44	16.54	−97.15	2.44	.22	1.66	32.67
1200.0	1.45	16.42	−105.87	2.85	.26	1.60	32.92
1300.0	1.43	16.26	−116.21	1.64	.29	1.50	33.23
1400.0	1.41	16.33	−126.79	.20	.28	1.50	33.39
1500.0	1.36	16.36	−136.11	.02	.27	1.49	33.63
1600.0	1.30	16.20	−146.31	−1.04	.27	1.54	33.63
1700.0	1.21	16.16	−155.22	−.82	.24	1.57	33.64
1800.0	1.13	16.11	−163.79	−.25	.26	1.60	33.26
1900.0	1.11	16.15	−173.75	−1.08	.27	1.62	32.79
2000.0	1.23	16.43	176.59	−1.62	.28	1.55	32.16

REF PLANES = 4.80 7.40 12.20

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS
37.60 MA

FREQ MHz	11		21		12		22	
	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.123	−171.3	16.410	−9.6	−30.503	1.1	.180	−177.0
200.00	.126	−166.6	16.256	−18.2	−30.551	.4	.189	−174.4
300.00	.130	−160.1	16.122	−26.8	−30.721	−1.1	.207	−173.7
400.00	.135	−152.7	16.170	−36.6	−31.091	−.9	.226	−173.5
500.00	.140	−147.9	16.329	−45.1	−31.167	−1.9	.246	−174.1
600.00	.151	−146.7	16.417	−54.0	−31.431	−2.5	.265	−176.2
700.00	.168	−146.2	16.614	−62.8	−31.537	−2.3	.286	−179.4
800.00	.188	−142.7	16.505	−71.3	−31.872	−2.6	.297	177.3
900.00	.193	−138.9	16.485	−79.2	−32.074	−2.2	.304	172.1
1000.00	.194	−139.5	16.545	−87.7	−32.430	−1.7	.299	164.8
1100.00	.210	−139.9	16.396	−96.2	−32.821	−3.4	.297	157.5
1200.00	.205	−138.4	16.142	−106.5	−33.044	−5.9	.280	148.3
1300.00	.192	−138.3	16.221	−116.4	−33.275	−5.9	.258	138.0
1400.00	.183	−138.4	16.366	−126.0	−33.473	−7.0	.225	124.2
1500.00	.163	−138.6	16.256	−134.5	−33.646	−11.1	.210	111.0
1600.00	.143	−138.3	16.162	−143.8	−33.738	−13.2	.193	92.9
1700.00	.115	−132.1	16.175	−153.4	−33.560	−15.6	.182	79.6
1800.00	.079	−112.0	16.180	−162.2	−33.228	−16.1	.185	59.6
1900.00	.072	−74.9	16.347	−171.8	−32.786	−19.4	.185	47.2
2000.00	.120	−48.1	16.386	−176.7	−32.129	−21.3	.206	28.3
2500.00	.509	−70.2	16.628	−115.1	−29.189	−45.7	.235	−48.4
3000.00	.406	−89.4	13.788	14.5	−31.971	−82.9	.491	−125.7
3500.00	.800	−124.5	−2.301	−51.6	−35.785	−45.9	.323	−148.9
4000.00	.918	−158.4	−21.583	−65.4	−39.128	−26.5	.310	−162.9

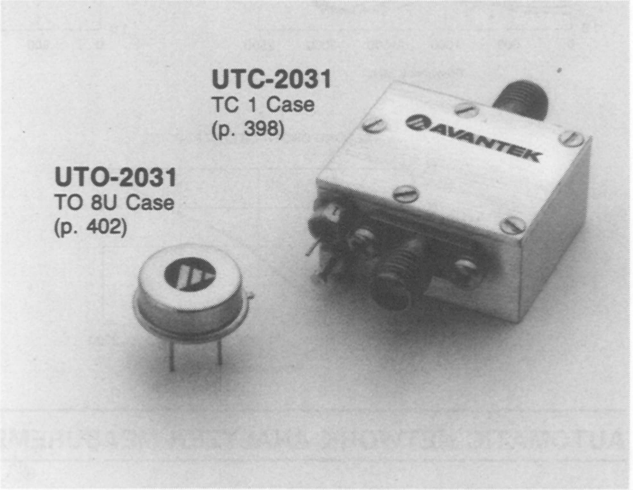
2031 Series

Thin Film Cascadable Amplifier 1-2000 MHz

AVANTEK

FEATURES

- **1-2000 MHz Frequency Coverage**
- **4.0 dBm Noise Figure**



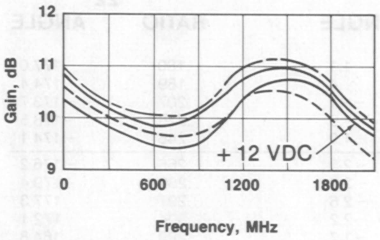
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	1-2000	1-2000	1-2000	MHz
GP	Small Signal Gain	10.5	9.0 Min.	8.5 Min.	dB
—	Gain Flatness	±0.6	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.0	5.5 Max.	5.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+3.0	+2.0 Min.	+2.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+14.0	—	—	dBm
I_D	DC Current	16	—	—	mA

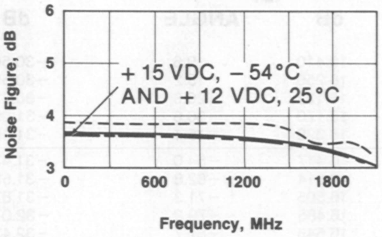
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

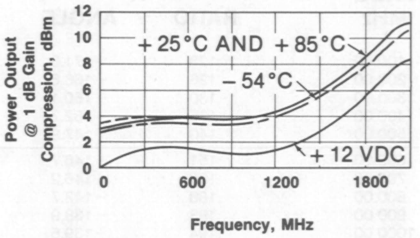
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

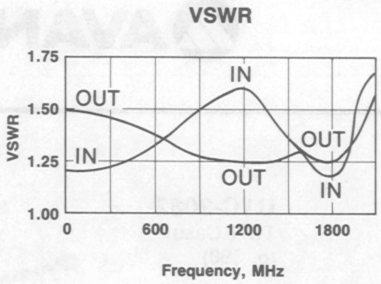
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS*

θ_{JC}	165°C/W
Active Transistor Power Dissipation	126 mW
Junction Temperature Above Case Temperature	21°C
MTBF	722,789 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.19	11.26	166.23	–6.03	.00	1.49	18.82
200.0	1.21	11.18	153.28	–5.27	.36	1.46	18.88
300.0	1.23	11.09	140.08	–4.74	.36	1.43	18.92
400.0	1.27	11.08	127.41	–3.69	.34	1.41	19.00
500.0	1.31	11.06	115.25	–2.14	.33	1.38	19.03
600.0	1.36	11.00	103.46	–.23	.33	1.35	19.08
700.0	1.42	10.96	91.63	1.64	.31	1.32	19.13
800.0	1.48	10.98	80.57	4.29	.33	1.30	19.20
900.0	1.54	11.04	68.43	5.88	.35	1.28	19.27
1000.0	1.59	11.14	55.49	6.63	.37	1.27	19.41
1100.0	1.61	11.31	41.97	6.81	.38	1.27	19.61
1200.0	1.60	11.44	27.77	6.31	.40	1.28	19.81
1300.0	1.55	11.50	12.82	5.07	.43	1.28	20.01
1400.0	1.47	11.53	–2.70	3.26	.43	1.29	20.08
1500.0	1.38	11.42	–18.15	1.53	.43	1.29	19.97
1600.0	1.29	11.24	–33.69	–.29	.44	1.28	19.77
1700.0	1.22	11.05	–49.74	–2.63	.44	1.25	19.50
1800.0	1.19	10.89	–65.46	–4.62	.44	1.24	19.23
1900.0	1.25	10.69	–81.19	–6.63	.45	1.25	18.93
2000.0	1.41	10.35	–97.89	–9.62	.48	1.35	18.78
2100.0	1.70	9.89	–115.76	–	.51	1.52	18.67
2200.0	2.15	9.24	–134.59	–	.54	1.76	18.82

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.088	–171.5	11.224	166.2	–18.937	–6.7	.191	166.7
200.00	.094	–162.9	11.157	153.0	–18.895	–13.7	.188	154.2
300.00	.104	–156.4	11.064	139.8	–19.000	–20.3	.179	141.5
400.00	.117	–151.1	11.057	126.8	–19.069	–26.6	.172	129.2
500.00	.136	–149.1	11.036	114.7	–19.059	–33.7	.162	119.0
600.00	.157	–148.2	10.993	102.7	–19.064	–40.5	.151	108.4
700.00	.183	–150.3	10.979	90.8	–19.144	–48.0	.137	98.6
800.00	.207	–154.1	10.988	79.5	–19.215	–54.7	.126	88.4
900.00	.231	–160.5	11.062	67.3	–19.276	–60.7	.115	77.5
1000.00	.252	–167.2	11.177	54.3	–19.411	–67.6	.107	64.1
1100.00	.261	–175.4	11.352	40.6	–19.593	–74.6	.104	48.3
1200.00	.259	175.7	11.502	26.3	–19.812	–81.1	.105	29.3
1300.00	.243	165.6	11.616	11.1	–19.975	–86.7	.110	9.7
1400.00	.210	154.9	11.659	–4.6	–20.031	–92.5	.116	–10.1
1500.00	.171	144.0	11.544	–20.4	–19.874	–98.0	.119	–26.6
1600.00	.124	130.1	11.363	–36.1	–19.667	–104.0	.120	–39.2
1700.00	.080	104.0	11.174	–52.5	–19.411	–110.1	.118	–44.2
1800.00	.061	46.4	11.033	–68.6	–19.136	–117.3	.117	–41.6
1900.00	.108	–4.8	10.797	–84.6	–18.878	–125.9	.133	–34.1
2000.00	.192	–28.7	10.450	–101.6	–18.706	–135.7	.171	–29.2
2100.00	.299	–44.6	9.950	–119.5	–18.655	–146.5	.230	–31.7
2200.00	.415	–58.7	9.272	–138.4	–18.784	–158.3	.296	–39.5
2300.00	.521	–72.7	8.307	–157.7	–19.149	–170.6	.350	–49.4
2400.00	.615	–85.5	7.085	–176.6	–19.758	178.5	.386	–60.3
2500.00	.689	–97.2	5.641	165.3	–20.423	167.3	.402	–70.3

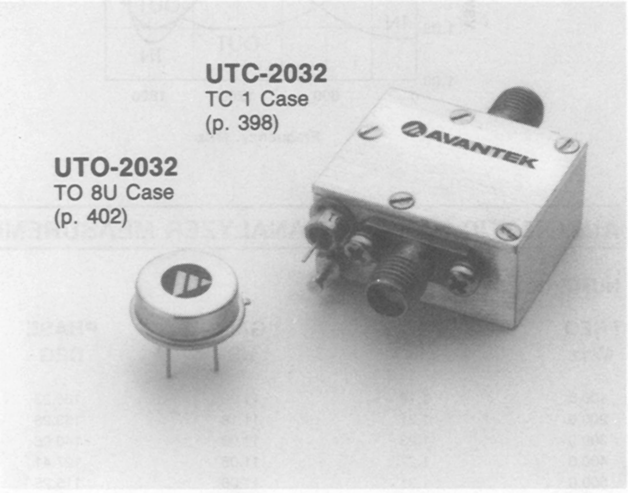
2032 Series

Thin Film Cascadable Amplifier 1-2000 MHz

AVANTEK

FEATURES

- **1-2000 MHz Frequency Coverage**



UTC-2032
TC 1 Case
(p. 398)

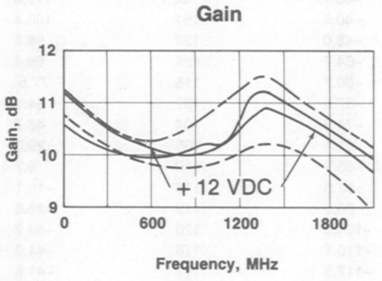
UTO-2032
TO 8U Case
(p. 402)

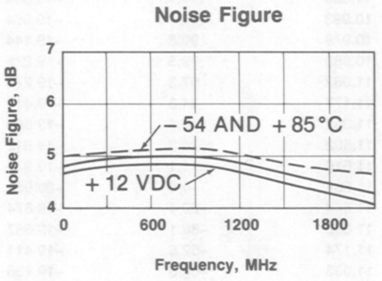
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

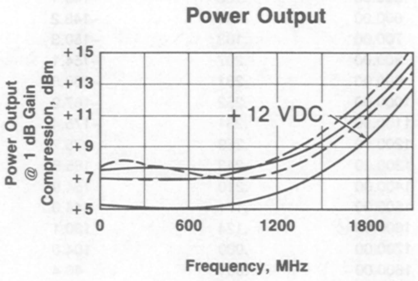
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	1-2000	1-2000	1-2000	MHz
GP	Small Signal Gain	10.0	9.0 Min.	8.5 Min.	dB
—	Gain Flatness	±0.6	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	5.0	6.0 Max.	6.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+7.5	+7.0 Min.	+6.5 Min.	dBm
—	Input VSWR	<1.8:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+17.0	—	—	dBm
I_D	DC Current	25			mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM RATINGS

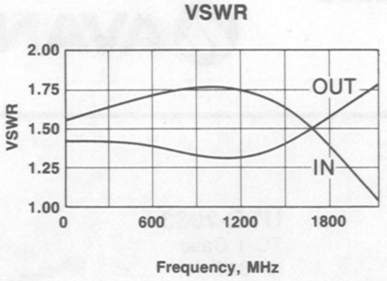
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +115°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +115°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 165°C/W
Active Transistor Power Dissipation .... 216 mW
Junction Temperature Above Case Temperature .... 36°C
MTBF .... 768,129 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.26	10.45	166.48	−7.64	.00	1.62	18.02
200.0	1.29	10.39	154.11	−6.19	.35	1.59	18.22
300.0	1.32	10.35	141.35	−5.12	.36	1.58	18.22
400.0	1.36	10.39	128.99	−3.66	.33	1.58	18.32
500.0	1.40	10.44	117.02	−1.80	.33	1.57	18.42
600.0	1.46	10.46	105.27	.25	.32	1.56	18.60
700.0	1.50	10.50	93.48	2.30	.31	1.55	18.69
800.0	1.56	10.57	82.37	5.01	.34	1.55	18.83
900.0	1.60	10.71	70.04	6.48	.35	1.55	19.00
1000.0	1.63	10.87	57.02	7.27	.37	1.55	19.24
1100.0	1.64	11.05	43.12	7.18	.39	1.56	19.50
1200.0	1.61	11.20	28.58	6.47	.41	1.56	19.76
1300.0	1.56	11.29	13.37	5.09	.43	1.55	19.95
1400.0	1.48	11.33	−2.31	3.23	.43	1.53	20.00
1500.0	1.40	11.26	−17.82	1.55	.43	1.48	19.84
1600.0	1.34	11.10	−33.49	−.28	.44	1.41	19.59
1700.0	1.29	10.95	−49.56	−2.52	.45	1.35	19.25
1800.0	1.31	10.89	−65.62	−4.75	.44	1.31	18.95
1900.0	1.38	10.76	−81.80	−7.11	.46	1.32	18.65
2000.0	1.55	10.46	−99.32	−10.81	.51	1.41	18.52
2100.0	1.86	10.00	−118.20	–	.54	.157	18.44
2200.0	2.33	9.26	−138.11	–	.56	1.77	18.60

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.186	179.5	10.505	166.7	−18.576	−6.6	.268	166.3
200.00	.184	179.2	10.452	154.2	−18.519	−12.5	.261	153.2
300.00	.183	179.4	10.393	141.6	−18.585	−19.2	.254	139.8
400.00	.180	−179.5	10.405	129.1	−18.655	−25.5	.249	126.7
500.00	.185	−177.8	10.410	117.4	−18.645	−32.5	.239	115.3
600.00	.190	−175.8	10.410	105.9	−18.672	−39.2	.227	103.3
700.00	.204	−175.2	10.4268	94.4	−18.801	−46.0	.212	91.3
800.00	.220	−175.7	10.456	83.7	−18.855	−52.7	.202	78.7
900.00	.239	−178.3	10.570	71.8	−18.982	−58.5	.190	65.0
1000.00	.257	178.2	10.723	59.5	−19.201	−64.8	.184	49.7
1100.00	.267	172.4	10.906	46.1	−19.411	−71.3	.183	32.4
1200.00	.268	165.7	11.096	32.3	−19.628	−76.8	.189	13.7
1300.00	.257	157.8	11.236	17.4	−19.762	−81.5	.199	−5.4
1400.00	.232	149.7	11.306	2.2	−19.845	−86.1	.209	−24.5
1500.00	.201	141.9	11.242	−13.1	−19.678	−91.0	.215	−42.0
1600.00	.165	134.8	11.088	−28.2	−19.386	−96.1	.213	−57.7
1700.00	.130	124.8	10.896	−43.7	−19.083	−101.6	.204	−69.8
1800.00	.096	109.6	10.809	−59.0	−18.775	−108.0	.184	−78.0
1900.00	.074	75.1	10.722	−73.9	−18.472	−114.9	.157	−80.1
2000.00	.085	23.5	10.576	−89.7	−18.191	−122.7	.132	−71.2
2100.00	.150	−12.3	10.340	−106.5	−17.919	−131.8	.139	−53.6
2200.00	.245	−34.2	10.002	−124.8	−17.733	−142.2	.188	−42.5
2300.00	.351	−51.3	9.410	−144.2	−17.726	−153.4	.257	−43.7
2400.00	.458	−67.1	8.497	−164.3	−17.862	−164.8	.327	−50.8
2500.00	.551	−81.4	7.273	176.0	−18.237	−176.1	.377	−59.9

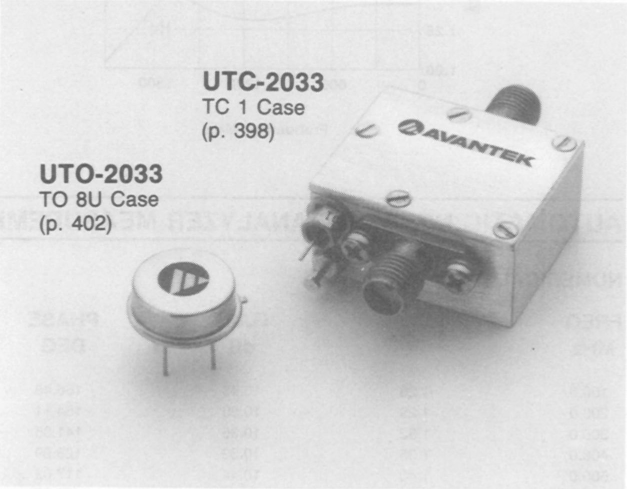
2033 Series

Thin Film Cascadable Amplifier 1-2000 MHz

AVANTEK

FEATURES

- **1-2000 MHz Frequency Coverage**
- **+16.0 dBm Output Power**



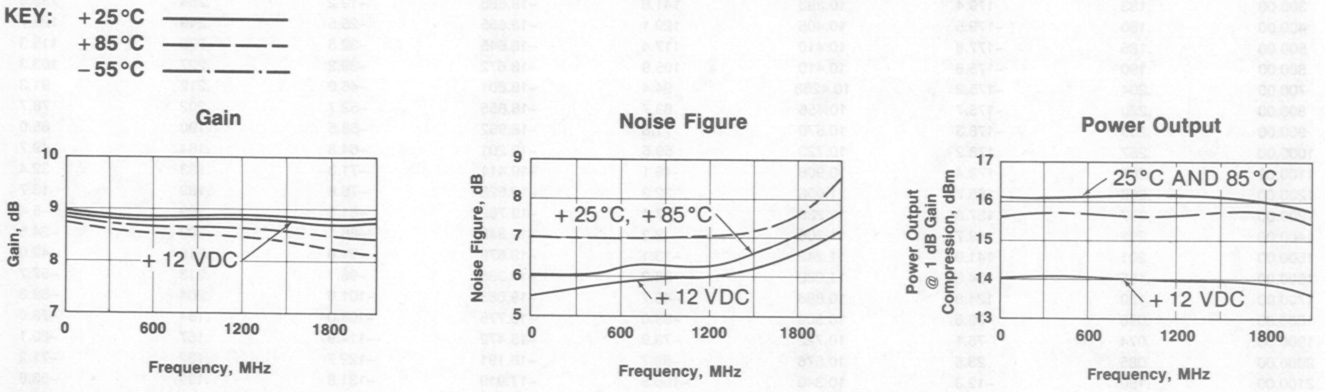
UTC-2033
TC 1 Case
(p. 398)

UTO-2033
TO 8U Case
(p. 402)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	Guaranteed Specifications $T_C = -55°\text{-}+85°C$	Unit
BW	Frequency Range	1-2000	1-2000	1-2000	MHz
GP	Small Signal Gain	8.5	8.0 Min.	7.5 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	6.5	8.5 Max.	9.5 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+16.0	+14.0 Min.	+14.0 Min.	dBm
—	Input VSWR	<1.8:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+30.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+41.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+46.0	—	—	dBm
I_D	DC Current	50	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)



MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +85°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+85°C

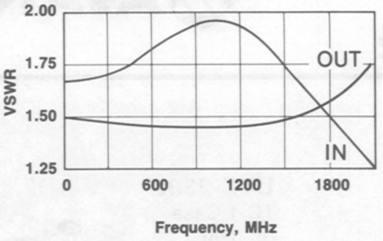
THERMAL CHARACTERISTICS*

θ_{JC}	110°C/W
Active Transistor Power Dissipation	600 mW
Junction Temperature Above Case Temperature	66°C
MTBF	857,646 Hrs.

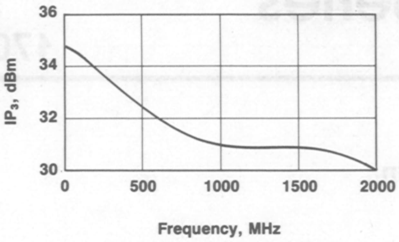
*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams

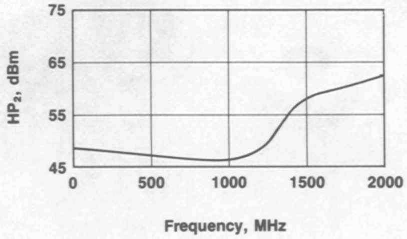
VSWR



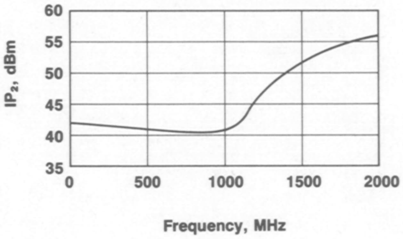
Third-Order Intercept Point



Second Harmonic Intercept Point



Second-Order Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
100.0	1.59	9.08	168.15	−1.16	.00	1.48	15.29
200.0	1.61	9.03	156.52	−1.27	.33	1.47	15.34
300.0	1.63	8.96	144.62	−1.67	.33	1.46	15.38
400.0	1.66	8.97	132.82	−1.96	.31	1.45	15.51
500.0	1.69	8.98	121.76	−1.51	.30	1.44	15.61
600.0	1.73	8.94	110.90	−.85	.30	1.42	15.72
700.0	1.75	8.86	100.15	−.10	.28	1.40	15.82
800.0	1.78	8.80	90.08	1.35	.31	1.37	15.92
900.0	1.78	8.75	79.14	1.92	.31	1.35	16.01
1000.0	1.79	8.71	68.05	2.34	.31	1.32	16.07
1200.0	1.76	8.67	45.08	2.40	.32	1.31	16.25
1400.0	1.69	8.63	21.55	1.91	.33	1.35	16.36
1600.0	1.58	8.65	−2.46	.94	.34	1.46	16.32
1800.0	1.43	8.59	−28.04	−1.60	.37	1.60	16.29
2000.0	1.23	8.56	−55.05	−5.57	.38	1.73	16.22
2200.0	1.14	8.14	−82.83	–	.40	1.79	16.21
2400.0	1.49	7.29	−112.71	–	.43	1.79	16.39

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.241	−178.1	8.611	168.7	−15.091	−6.1	.182	161.6
200.00	.242	−178.7	8.589	157.1	−15.207	−13.1	.179	147.1
300.00	.247	−179.7	8.543	145.5	−15.262	−19.4	.181	131.2
400.00	.250	179.3	8.575	133.8	−15.409	−25.3	.182	116.6
500.00	.258	178.0	8.614	122.9	−15.473	−31.7	.180	103.3
600.00	.263	176.9	8.613	112.3	−15.547	−38.0	.176	89.5
700.00	.272	175.1	8.621	101.7	−15.677	−44.3	.168	75.3
800.00	.277	172.8	8.619	91.6	−15.779	−50.1	.161	60.4
900.00	.282	170.3	8.630	80.7	−15.773	−55.0	.149	44.2
1000.00	.283	168.1	8.663	69.5	−15.849	−61.0	.139	25.0
1200.00	.275	162.2	8.758	46.2	−16.031	−73.1	.128	−18.9
1400.00	.249	154.1	8.886	22.2	−16.145	−85.6	.139	−65.7
1600.00	.200	143.2	9.013	−2.8	−16.116	−98.1	.167	−107.1
1800.00	.119	126.5	9.059	−29.8	−16.163	−110.6	.191	−143.6
2000.00	.026	27.6	9.063	−58.5	−16.245	−124.1	.209	−178.0
2200.00	.164	−60.6	8.539	−87.8	−16.442	−139.7	.219	144.2
2400.00	.330	−83.1	7.508	−118.7	−16.906	−156.7	.227	109.4

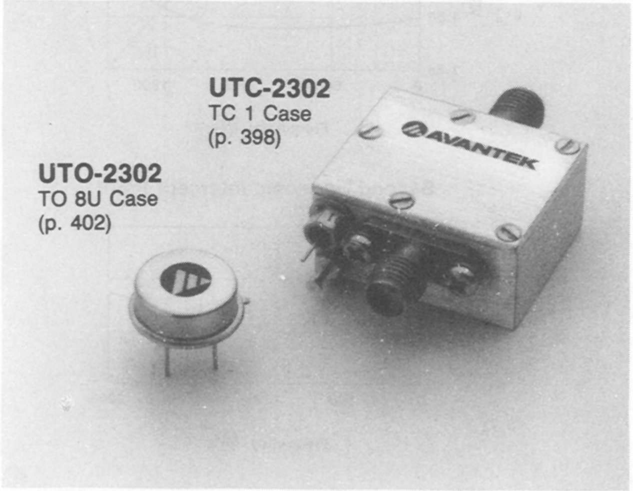
2302 Series

Thin Film Cascadable Amplifier 1700-2300 MHz

AVANTEK

FEATURES

- **10.5 dB Gain**



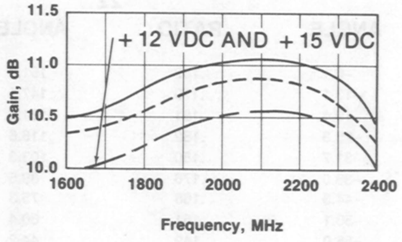
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical T_C = 25°C	Guaranteed Specifications T_C = 0°-50°C	Guaranteed Specifications T_C = −55°- +85°C	Unit
BW	Frequency Range	1700-2300	1700-2300	1700-2300	MHz
GP	Small Signal Gain	10.5	8.0 Min.	8.0 Min.	dB
—	Gain Flatness	±0.3	±0.5 Max.	±1.0 Max.	dB
NF	Noise Figure	5.0	6.5 Max.	7.0 Max.	dB
$P_{1\,dB}$	Power Output @ +1 dB Compression	+8.0	+3.0 Min.	+2.0 Min.	dBm
—	Input VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	<1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+13.0	—	—	dBm
I_D	DC Current	18	—	—	mA

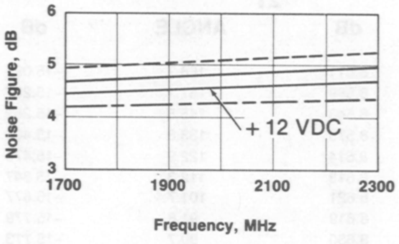
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—

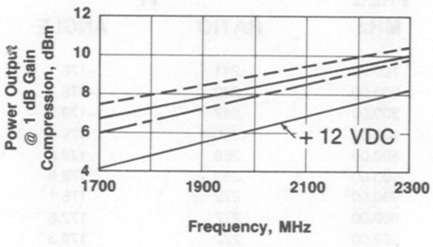
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

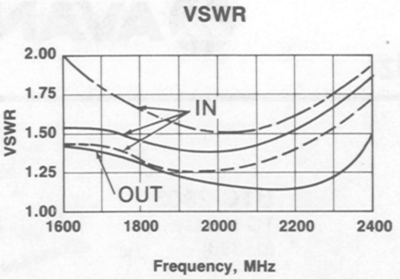
DC Voltage .... +17 Volts
Continuous RF Input Power .... +13 dBm
Operating Case Temperature .... −55°C to +125°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

THERMAL CHARACTERISTICS*

θ_{JC} .... 165°C/W
Active Transistor Power Dissipation .... 130 mW
Junction Temperature Above Case Temperature .... 21°C
MTBF .... 700,593 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
400.0	4.43	8.86	– 156.61	—	—	.98	2.04	28.14
500.0	2.46	10.44	171.17	—	—	.80	1.85	26.08
600.0	1.91	10.94	145.35	—	—	.62	1.69	25.26
700.0	1.77	10.97	125.73	—	—	.49	1.61	24.76
800.0	1.76	10.74	109.58	– 2.56	—	.43	1.56	24.39
900.0	1.81	10.57	94.94	– 3.32	—	.39	1.54	24.04
1000.0	1.84	10.42	81.39	– 3.00	—	.36	1.51	23.61
1100.0	1.86	10.34	68.28	– 2.23	—	.36	1.50	23.22
1200.0	1.88	10.26	55.71	– .91	—	.35	1.49	22.75
1300.0	1.88	10.24	43.20	.44	—	.35	1.48	22.27
1400.0	1.85	10.28	30.46	1.59	—	.35	1.46	21.75
1500.0	1.83	10.35	17.82	2.83	—	.35	1.45	21.31
1600.0	1.79	10.48	5.16	4.04	—	.36	1.43	20.82
1700.0	1.75	10.56	– 7.87	4.87	– 1.72	.37	1.40	20.39
1800.0	1.70	10.70	– 21.84	4.78	– .14	.40	1.36	19.91
1900.0	1.66	10.83	– 36.58	3.90	.64	.42	1.31	19.44
2000.0	1.61	11.01	– 51.85	2.48	.89	.42	1.23	19.06
2100.0	1.60	11.08	– 67.17	1.05	1.12	.44	1.13	18.79
2200.0	1.67	11.00	– 83.76	– 1.65	.09	.48	1.07	18.68
2300.0	1.82	10.77	– 101.62	– 5.63	– 2.21	.50	1.19	18.78
2400.0	2.15	10.37	– 119.98	– 10.10	—	.53	1.39	19.11
2500.0	2.63	9.70	– 139.72	—	—	.55	1.65	19.83
LINEARIZATION RANGE:				800.0 TO 2400.0	1700.0 TO 2300.0			

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15.00 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
300.00	.861	– 152.9	3.553	– 121.6	– 34.830	104.4	.385	– 101.6
400.00	.646	172.4	9.381	– 162.3	– 27.922	71.3	.371	– 133.9
500.00	.473	154.6	10.645	168.1	– 26.023	49.1	.343	– 162.7
600.00	.376	146.4	11.003	143.8	– 24.958	35.8	.316	171.8
700.00	.334	143.1	10.994	125.5	– 24.390	25.2	.306	150.1
800.00	.315	142.1	10.845	111.4	– 24.007	19.9	.297	134.1
900.00	.309	138.9	10.660	96.8	– 23.482	12.3	.292	118.1
1000.00	.308	135.0	10.532	82.9	– 22.964	5.9	.282	102.9
1100.00	.308	129.8	10.448	69.9	– 22.519	– 1.5	.273	88.6
1200.00	.311	125.4	10.387	58.7	– 22.030	– 6.6	.261	77.6
1300.00	.306	118.5	10.370	44.9	– 21.646	– 13.7	.246	61.9
1400.00	.300	110.4	10.385	30.9	– 21.169	– 20.8	.228	46.3
1500.00	.289	102.8	10.464	18.3	– 20.586	– 27.9	.210	30.8
1600.00	.277	94.1	10.570	6.4	– 20.267	– 34.5	.191	15.0
1700.00	.260	83.9	10.651	– 5.5	– 19.850	– 40.9	.175	– 1.8
1800.00	.237	69.0	10.722	– 21.6	– 19.375	– 50.8	.152	– 25.2
1900.00	.212	53.5	10.779	– 35.5	– 18.936	– 59.8	.134	– 46.3
2000.00	.189	36.9	10.933	– 46.8	– 18.575	– 66.2	.120	– 65.4
2100.00	.168	7.1	10.967	– 63.1	– 18.248	– 77.0	.095	– 93.3
2200.00	.179	– 31.4	10.927	– 80.3	– 18.106	– 88.6	.067	– 132.0
2300.00	.224	– 64.6	10.682	– 96.8	– 18.000	– 100.7	.051	161.5
2400.00	.297	– 90.2	10.376	– 113.5	– 18.096	– 113.4	.083	99.2
2500.00	.390	– 112.3	9.817	– 131.6	– 18.622	– 126.6	.146	60.3
2600.00	.490	– 132.8	8.981	– 151.6	– 19.486	– 142.1	.226	32.3
2700.00	.604	– 155.1	7.713	– 175.9	– 20.859	– 163.0	.319	5.6
2800.00	.672	– 168.4	6.382	169.4	– 22.149	– 173.9	.377	– 10.5
2900.00	.751	171.9	4.344	145.9	– 24.913	167.6	.440	– 33.2
3000.00	.792	161.5	2.636	132.5	– 27.657	154.4	.467	– 46.3

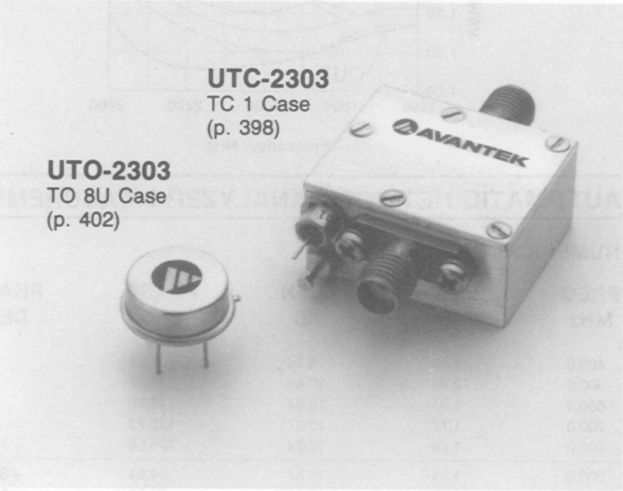
2303 Series

Thin Film Cascadable Amplifier 1700-2300 MHz

AVANTEK

FEATURES

- **9.0 dB Gain Stage**
- **+12.0 dBm Output Power**



UTC-2303
TC 1 Case
(p. 398)

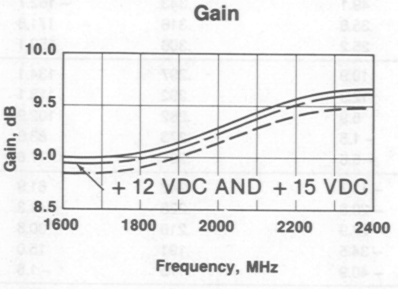
UTO-2303
TO 8U Case
(p. 402)

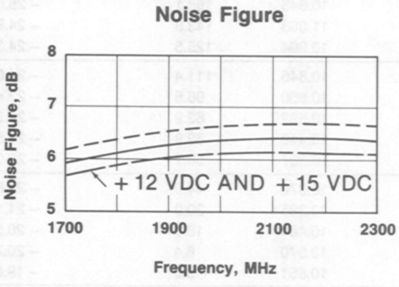
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

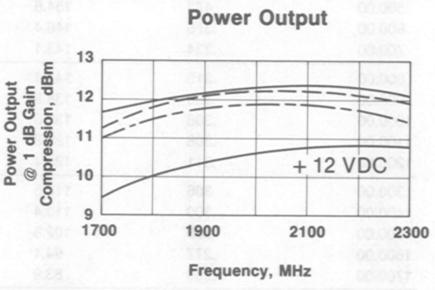
Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		T_C = 25°C	T_C = 0°-50°C	T_C = −55°- +85°C	
BW	Frequency Range	1700-2300	1700-2300	1700-2300	MHz
GP	Small Signal Gain	9.0	8.0 Min.	8.0 Min.	dB
—	Gain Flatness	±0.4	±0.5 Max.	±1.0 Max.	dB
NF	Noise Figure	6.5	8.0 Max.	8.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+12.0	+10.0 Min.	+9.0 Min.	dBm
—	Input VSWR	< 1.8:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	< 1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+20.0	—	—	dBm
I_D	DC Current	30	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ———
+85°C — — —
−55°C —·—·—







MAXIMUM RATINGS

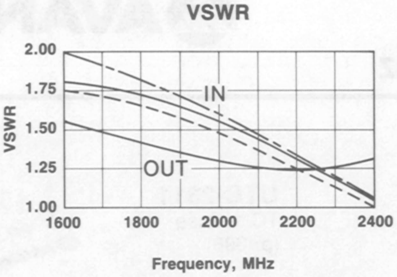
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	−55°C to +115°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+115°C

THERMAL CHARACTERISTICS*

θ_{JC}	165°C/W
Active Transistor Power Dissipation	250 mW
Junction Temperature Above Case Temperature	41°C
MTBF	635,427 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO—2.1 grams; UTC—21.5 grams



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
400.0	4.88	8.30	– 156.19	—	—	.93	2.39	29.60
500.0	2.78	9.81	174.10	—	—	.73	2.24	26.92
600.0	2.11	10.15	151.18	—	—	.55	2.14	26.13
700.0	1.86	10.14	133.71	—	—	.43	2.09	25.47
800.0	1.78	9.93	119.37	1.89	—	.37	2.04	25.03
900.0	1.77	9.67	106.47	– .06	—	.34	1.99	24.51
1000.0	1.78	9.45	94.59	– 1.02	—	.32	1.94	24.13
1100.0	1.81	9.27	83.58	– 1.10	—	.30	1.89	23.61
1200.0	1.83	9.13	72.70	– 1.05	—	.30	1.84	23.01
1300.0	1.85	9.05	61.94	– .88	—	.29	1.77	22.40
1400.0	1.84	8.98	51.35	– .55	—	.29	1.73	21.94
1500.0	1.86	8.99	40.98	.00	—	.29	1.67	21.39
1600.0	1.83	9.01	30.65	.59	—	.29	1.60	21.09
1700.0	1.79	9.08	20.28	1.14	– 1.01	.28	1.55	20.67
1800.0	1.73	9.13	9.93	1.70	.01	.29	1.49	20.13
1900.0	1.68	9.19	– .70	1.93	.69	.31	1.44	19.82
2000.0	1.59	9.32	– 12.56	1.06	.29	.33	1.39	19.31
2100.0	1.49	9.50	– 24.02	.52	.21	.32	1.35	18.88
2200.0	1.37	9.64	– 35.61	– .14	.00	.32	1.34	18.55
2300.0	1.24	9.74	– 47.67	– 1.30	– .69	.34	1.34	18.37
2400.0	1.09	9.74	– 60.33	– 3.03	—	.35	1.36	18.25
2500.0	1.05	9.78	– 73.64	—	—	.39	1.47	18.27
LINEARIZATION RANGE:				800.0 TO 2400.0	1700.0 TO 2300.0			

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
300.00	.874	– 149.6	1.299	– 114.5	– 36.858	105.8	.367	– 95.8
400.00	.673	173.5	8.183	– 152.5	– 28.607	74.6	.353	– 124.3
500.00	.478	152.4	9.931	177.8	– 26.231	53.0	.330	– 151.3
600.00	.346	143.6	10.436	152.3	– 24.947	37.6	.304	– 176.0
700.00	.275	144.9	10.454	133.3	– 24.613	26.3	.293	162.4
800.00	.253	150.4	10.229	119.1	– 24.369	20.1	.288	147.6
900.00	.258	153.4	9.899	104.8	– 24.020	12.0	.284	132.9
1000.00	.274	153.5	9.571	91.6	– 23.613	6.2	.275	120.1
1100.00	.290	151.3	9.316	79.8	– 23.307	.6	.270	109.0
1200.00	.307	148.4	9.090	70.0	– 22.921	– 3.0	.258	100.5
1300.00	.321	143.4	8.869	58.0	– 22.456	– 9.9	.246	89.2
1400.00	.329	137.6	8.722	46.3	– 22.147	– 15.2	.226	78.7
1500.00	.334	132.3	8.630	36.0	– 21.730	– 20.3	.208	68.0
1600.00	.333	127.6	8.616	26.7	– 21.451	– 24.8	.184	57.5
1700.00	.327	122.0	8.600	17.5	– 21.048	– 29.9	.162	45.6
1800.00	.318	114.1	8.648	5.2	– 20.507	– 36.6	.133	27.9
1900.00	.303	107.8	8.636	– 4.5	– 20.163	– 42.3	.109	8.1
2000.00	.282	104.0	8.747	– 12.3	– 19.747	– 46.3	.093	– 14.7
2100.00	.252	96.3	8.856	– 24.9	– 19.150	– 54.4	.088	– 48.8
2200.00	.211	87.2	9.025	– 37.5	– 18.799	– 62.9	.096	– 86.0
2300.00	.161	82.0	9.089	– 48.8	– 18.454	– 70.6	.119	– 113.7
2400.00	.102	77.1	9.168	– 60.1	– 18.148	– 79.2	.148	– 136.1
2500.00	.036	90.2	9.167	– 72.5	– 18.040	– 88.1	.177	– 157.6
2600.00	.058	– 154.7	9.115	– 86.5	– 17.893	– 98.9	.215	– 179.3
2700.00	.164	– 156.2	8.939	– 104.9	– 18.140	– 114.2	.256	155.7
2800.00	.252	– 162.1	8.659	– 116.9	– 18.374	– 123.8	.289	138.8
2900.00	.382	– 176.0	8.160	– 138.6	– 19.004	– 141.8	.329	112.4
3000.00	.474	175.5	7.656	– 152.1	– 19.945	– 153.4	.356	94.8

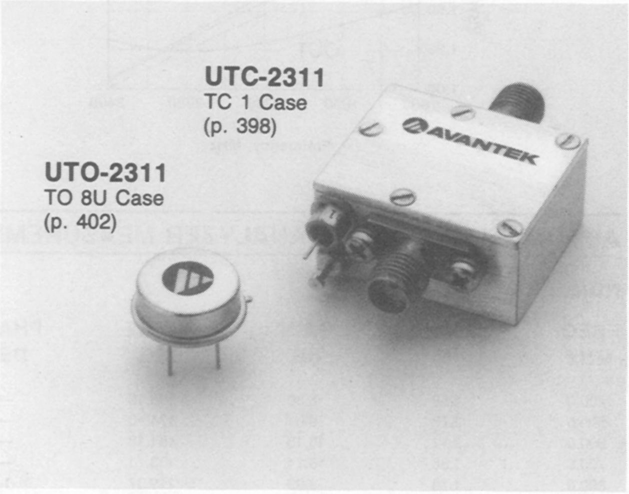
2311 Series

Thin Film Cascadable Amplifier 1700-2300 MHz

AVANTEK

FEATURES

- **4.5 dB Noise Figure**



UTC-2311
TC 1 Case
(p. 398)

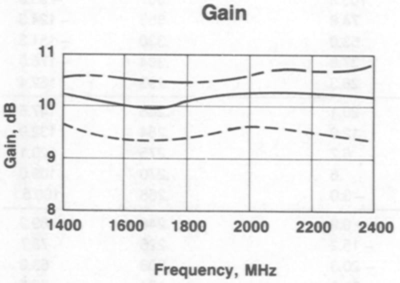
UTO-2311
TO 8U Case
(p. 402)

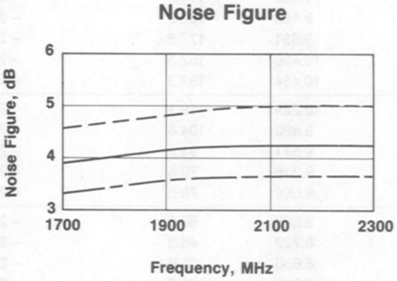
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

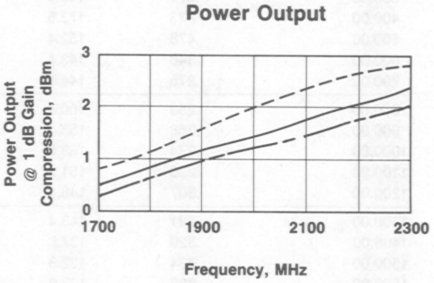
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°-50°C$	Guaranteed Specifications $T_C = -55°- +85°C$	Unit
BW	Frequency Range	1700-2300	1700-2300	1700-2300	MHz
GP	Small Signal Gain	10.0	8.0 Min.	8.0 Min.	dB
—	Gain Flatness	±0.2	±0.5 Max.	±1.0 Max.	dB
NF	Noise Figure	4.5	5.0 Max.	5.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+1.0	-3.0 Min.	-4.0 Min.	dBm
—	Input VSWR	< 1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	< 1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+10.0	—	—	dBm
I_D	DC Current	15	—	—	mA

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
-55°C –·–·–·–







MAXIMUM RATINGS

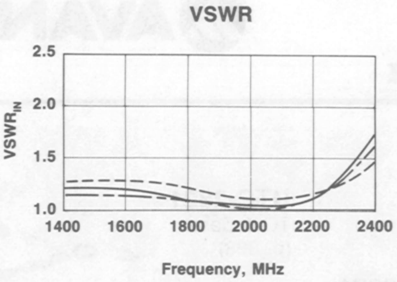
DC Voltage	+17 Volts
Continuous RF Input Power	+13 dBm
Operating Case Temperature	-55°C to +125°C
Storage Temperature	-62°C to +150°C
"R" Series Burn-In Temperature	+125°C

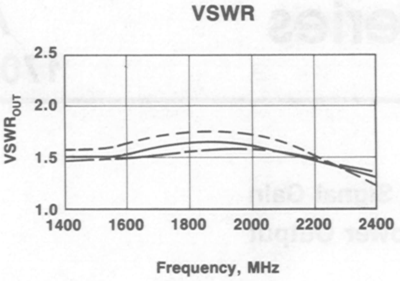
THERMAL CHARACTERISTICS*

θ_{JC}	165°C/W
Active Transistor Power Dissipation	70 mW
Junction Temperature Above Case Temperature	12°C
MTBF	710,737 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams





AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS **BIAS = 15.00 VOLTS**

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GPDEL NSEC	VSWR OUT	ISOL dB
400.0	5.41	8.91	–151.85	–	–	.95	2.21	27.73
500.0	3.09	10.67	177.69	–	–	.76	2.07	25.25
600.0	2.32	11.19	153.51	–	–	.59	1.99	24.19
700.0	2.00	11.33	134.79	–	–	.46	1.94	23.54
800.0	1.05	11.23	119.30	.40	–	.41	1.92	22.98
900.0	1.79	11.05	105.11	–1.23	–	.38	1.90	22.42
1000.0	1.76	10.89	91.93	–1.84	–	.35	1.88	21.99
1100.0	1.75	10.75	79.72	–1.50	–	.33	1.85	21.62
1200.0	1.75	10.65	67.57	–1.09	–	.34	1.81	20.92
1300.0	1.74	10.58	55.63	–.48	–	.33	1.74	20.32
1400.0	1.72	10.54	43.73	.17	–	.33	1.68	19.92
1500.0	1.69	10.58	31.97	.98	–	.33	1.61	19.47
1600.0	1.63	10.63	20.30	1.88	–	.33	1.51	19.16
1700.0	1.56	10.70	8.49	2.63	–1.24	.33	1.41	18.67
1800.0	1.47	10.73	–3.60	3.10	.14	.35	1.30	18.27
1900.0	1.39	10.78	–16.61	2.65	.60	.37	1.18	17.85
2000.0	1.29	10.88	–30.42	1.40	.26	.38	1.06	17.58
2100.0	1.22	10.95	–43.74	.64	.41	.37	1.09	17.29
2200.0	1.26	10.90	–57.49	–.53	.15	.39	1.25	17.18
2300.0	1.40	10.72	–72.30	–2.77	–1.17	.42	1.48	17.37
2400.0	1.63	10.27	–88.13	–6.04	–	.38	1.75	18.00
2500.0	1.92	10.01	–101.60	–	–	.46	1.93	17.86
LINAEARIZATION RANGE:				800.0 TO 2400.0	1700.0 TO 2300.0			

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.00	.818	–54.5	6.990	–153.5	–34.123	46.2	.604	–62.1
200.00	.931	–101.5	–2.432	140.8	–41.928	–12.8	.415	–78.3
300.00	.870	–147.9	3.407	–118.4	–35.814	113.4	.398	–101.3
400.00	.682	176.9	9.329	–157.3	–28.334	80.6	.380	–131.7
500.00	.522	155.8	10.785	174.5	–26.158	59.2	.359	–158.7
600.00	.418	142.8	11.314	150.4	–24.844	45.4	.339	177.2
700.00	.350	135.4	11.461	132.2	–23.862	35.4	.331	156.7
800.00	.311	132.8	11.381	118.1	–23.278	28.9	.328	141.9
900.00	.285	129.7	11.239	103.5	–22.606	21.7	.322	127.3
1000.00	.271	127.4	11.073	89.5	–21.803	13.5	.311	113.9
1100.00	.263	123.7	10.969	76.7	–21.405	5.6	.301	101.8
1200.00	.259	120.6	10.845	65.8	–20.783	1.1	.285	92.0
1300.00	.252	115.8	10.754	52.3	–20.251	–7.2	.263	79.9
1400.00	.241	108.9	10.696	39.0	–19.793	–15.2	.236	67.4
1500.00	.228	102.8	10.670	27.0	–19.158	–22.0	.207	55.0
1600.00	.212	95.4	10.689	16.0	–18.838	–29.3	.174	41.8
1700.00	.190	86.7	10.684	5.0	–18.341	–36.1	.142	26.5
1800.00	.156	73.7	10.664	–9.5	–17.978	–46.4	.100	.4
1900.00	.119	59.5	10.599	–21.6	–17.490	–54.6	.071	–33.3
2000.00	.082	40.1	10.643	–31.5	–17.207	–60.5	.070	–77.9
2100.00	.052	–15.7	10.626	–45.8	–16.854	–71.1	.090	–124.5
2200.00	.085	–79.3	10.563	–60.2	–16.890	–82.4	.126	–156.3
2300.00	.146	–107.6	10.369	–73.3	–16.807	–92.5	.169	–179.6
2400.00	.218	–123.1	10.135	–86.3	–16.906	–102.6	.209	160.5
2500.00	.298	–136.1	9.861	–100.4	–17.251	–114.6	.247	139.7
2700.00	.491	–164.7	8.887	–136.1	–18.667	–145.3	.325	91.6
2900.00	.666	170.3	7.252	–171.8	–21.845	–174.8	.380	43.9
3000.00	.795	153.7	5.277	162.5	–26.883	159.8	.397	7.1

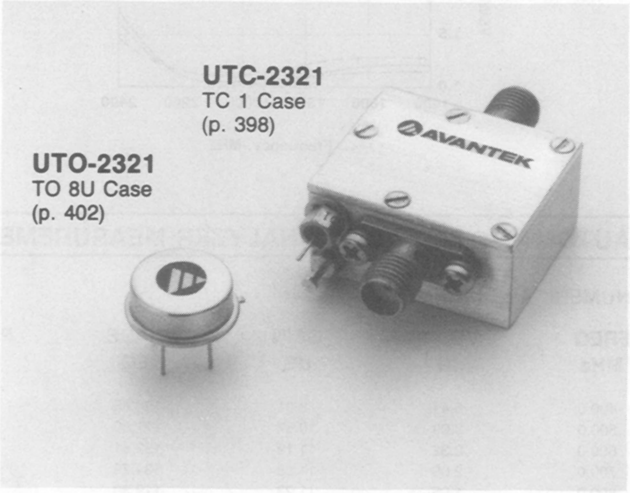
2321 Series

Thin Film Cascadable Amplifier 1700-2300 MHz

AVANTEK

FEATURES

- **15 dB Small Signal Gain**
- **+11 dBm Power Output**



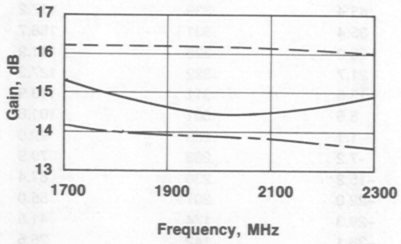
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	Guaranteed Specifications $T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	1700-2300	1700-2300	1700-2300	MHz
GP	Small Signal Gain	15.0	14.0 Min.	13.0 Min.	dB
—	Gain Flatness	±0.5	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	7.0	8.0 Max.	8.5 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+11.0	+10.0 Min.	+9.0 Min.	dBm
—	Input VSWR	1.8:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.6:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+23.0	—	—	dBm
I_D	DC Current	70	—	—	mA

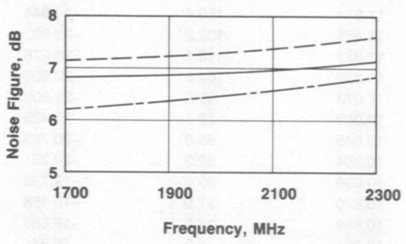
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — —
−55°C —·—·—

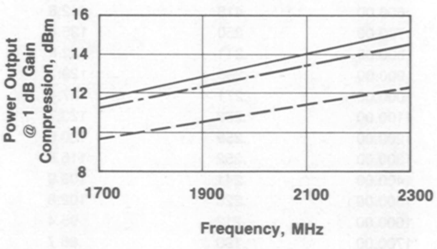
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

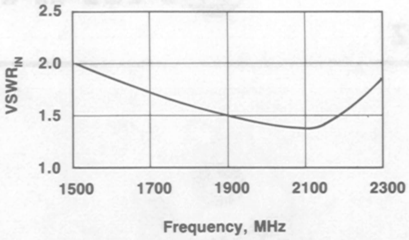
DC Voltage .... +17 Volts
Continuous RF Input Power .... +18 dBm
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +100°C

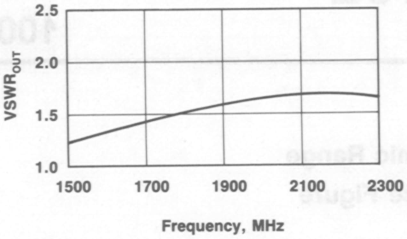
THERMAL CHARACTERISTICS*

θ_{JC} .... 165/110°C/W
Active Transistor Power Dissipation .... 180/450 mW
Junction Temperature Above Case Temperature .... 30/50°C
MTBF .... 953,751 Hrs.

*For further information, see High Reliability section.

WEIGHT: (typical) UTO — 2.1 grams; UTC — 21.5 grams


Input VSWR


Output VSWR

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
500.0	2.53	14.27	54.15	—	1.01	3.86	42.19
600.0	2.05	15.40	20.93	—	.85	3.00	40.12
700.0	2.01	15.93	– 7.33	—	.73	2.46	39.51
800.0	2.08	16.27	– 31.37	—	.62	2.06	38.85
900.0	2.21	16.21	– 52.07	—	.54	1.76	38.36
1000.0	2.27	16.06	– 69.93	—	.48	1.53	38.49
1100.0	2.30	15.76	– 86.55	—	.44	1.35	38.20
1200.0	2.29	15.60	– 101.64	—	.40	1.24	37.76
1300.0	2.19	15.32	– 115.02	—	.37	1.18	37.69
1400.0	2.13	15.01	– 128.55	—	.37	1.19	38.03
1500.0	2.00	14.80	– 141.86	—	.38	1.25	37.94
1600.0	1.88	14.76	– 155.69	—	.37	1.34	37.77
1700.0	1.72	14.80	– 168.27	– 1.95	.34	1.43	37.71
1800.0	1.58	14.52	179.58	.04	.35	1.57	36.65
1900.0	1.49	15.00	166.56	1.17	.37	1.56	38.68
2000.0	1.40	15.05	152.69	1.46	.39	1.64	38.57
2100.0	1.41	14.98	138.50	1.43	.42	1.67	38.64
2200.0	1.56	15.10	122.45	– .45	.44	1.67	38.95
2300.0	1.82	15.12	107.05	– 1.70	.47	1.66	39.53
2400.0	2.21	14.67	88.70	—	.52	1.61	39.45
2500.0	2.66	13.97	69.28	—	.50	1.55	39.21
2600.0	3.09	13.37	52.57	—	.48	1.48	40.23
2700.0	3.55	12.22	34.59	—	.48	1.43	40.52
2800.0	4.06	10.99	17.92	—	.46	1.43	40.94
2900.0	4.70	9.38	1.18	—	.44	1.49	40.95
3000.0	5.33	7.77	– 13.79	—	.00	1.60	40.96

LINEARIZATION RANGE: 1700.0 TO 2300.0

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
500.00	.437	– 73.5	13.952	53.4	– 42.019	134.1	.580	– 72.0
600.00	.345	– 67.1	15.169	21.3	– 40.348	119.9	.490	– 82.5
700.00	.328	– 60.8	15.698	– 6.4	– 39.169	110.8	.410	– 91.8
800.00	.363	– 57.9	16.075	– 30.5	– 38.765	107.2	.328	– 99.6
900.00	.371	– 59.1	16.066	– 50.9	– 38.267	103.3	.246	– 106.8
1000.00	.398	– 67.1	15.983	– 68.5	– 38.026	99.8	.179	– 112.1
1100.00	.411	– 71.3	15.653	– 85.2	– 38.166	98.3	.123	– 111.9
1200.00	.400	– 78.6	15.569	– 100.2	– 37.669	98.9	.080	– 99.9
1300.00	.400	– 84.8	15.309	– 113.8	– 37.939	96.8	.062	– 68.1
1400.00	.378	– 91.3	15.062	– 127.4	– 37.710	95.8	.075	– 40.3
1500.00	.363	– 98.9	14.850	– 141.0	– 37.955	96.6	.103	– 32.4
1600.00	.332	– 104.7	14.837	– 154.9	– 37.930	97.0	.136	– 31.2
1700.00	.290	– 115.0	14.881	– 167.8	– 37.876	97.1	.165	– 33.2
1800.00	.248	– 119.4	14.601	– 179.9	– 36.654	85.3	.202	– 43.6
1900.00	.207	– 141.5	15.025	166.9	– 38.709	91.2	.197	– 44.0
2000.00	.169	– 169.3	15.065	152.9	– 38.586	91.4	.222	– 50.7
2100.00	.148	152.0	15.016	138.7	– 38.698	89.0	.229	– 54.8
2200.00	.186	113.9	15.133	122.9	– 38.997	87.7	.226	– 59.9
2300.00	.259	85.4	15.155	107.5	– 39.194	83.2	.225	– 64.5
2400.00	.356	68.3	14.712	89.1	– 39.515	81.7	.211	– 67.6
2500.00	.440	54.2	14.071	69.7	– 39.410	72.8	.192	– 68.9
2600.00	.511	43.3	13.453	52.9	– 40.173	69.1	.168	– 66.4
2700.00	.566	34.5	12.331	34.8	– 40.402	62.8	.149	– 59.0
2800.00	.621	27.6	11.064	17.8	– 40.704	62.7	.150	– 47.2
2900.00	.665	23.1	9.439	1.2	– 40.619	56.0	.172	– 37.2
3000.00	.704	18.6	7.761	– 14.1	– 40.887	56.3	.204	– 33.2

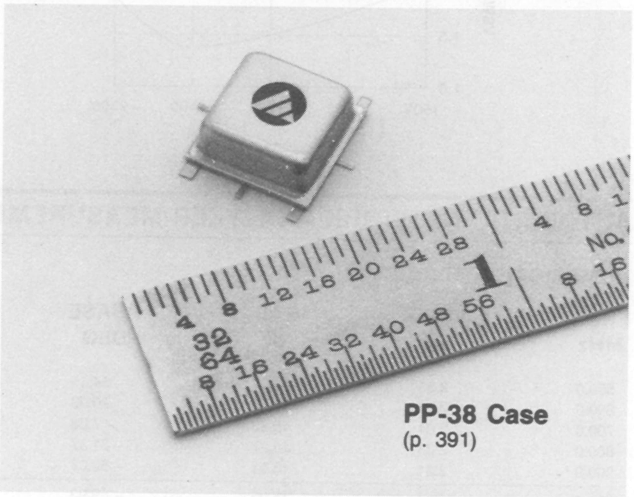
PPA-4132

Surface Mount Amplifier
1000-4000 MHz

AVANTEK

FEATURES

- **High Dynamic Range**
- **4.5 dB Noise Figure**
- **Wideband**



PP-38 Case
(p. 391)

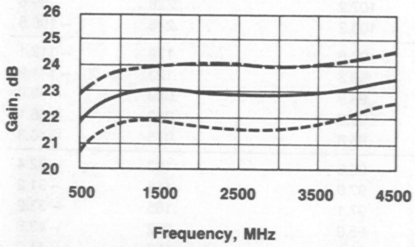
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +8 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°\text{-}50°C$	$T_C = -55°\text{-} +85°C$	Unit
BW	Frequency Range	500-4500	1000-4000	1000-4000	MHz
GP	Small Signal Gain	22.0	20.0 Min.	19.0 Min.	dB
—	Gain Flatness	±0.3	±1.0 Max.	±1.0 Max.	dB
NF	Noise Figure	4.5	6.0 Max.	7.0 Max.	dB
$P_{1\,dB}$	Power Output @ + 1 dB Compression	+18.5	+17.0 Min.	+16.0 Min.	dBm
—	Input VSWR	1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.5:1	2.0:1 Max.	2.0:1 Max.	
IP_3	Two Tone 3rd Order Intercept Point	+27.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+50.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+55.0	—	—	dBm
I_D	DC Current	150	—	—	mA

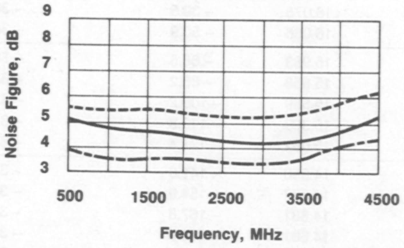
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +8 VDC unless otherwise noted)

KEY: +25°C ————
+85°C — — — —
−55°C —·—·—

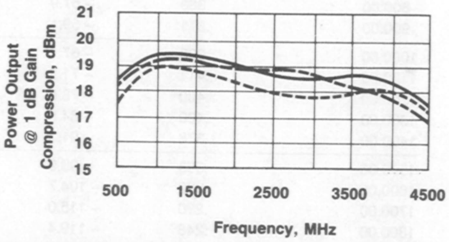
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

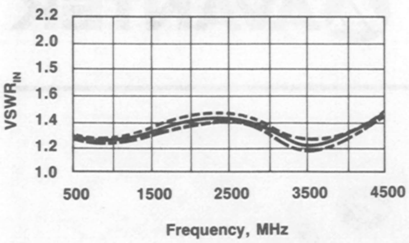
DC Voltage	+9 Volts
Continuous RF Input Power	+15 dBm
Operating Case Temperature	−55°C to +115°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+115°C

THERMAL CHARACTERISTICS*

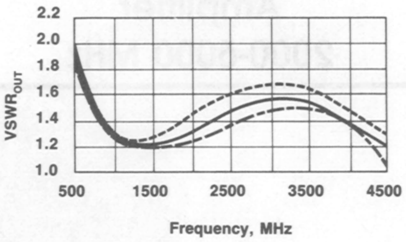
θ_{JC} [1]	100/100°C/W
Active Transistor Power Dissipation[1]	290/370 mW
Junction Temperature Above Case Temperature[1]	29/37°C

NOTE 1: Values refer to 1st and 2nd stage transistors respectively.
*For further information, see High Reliability section.

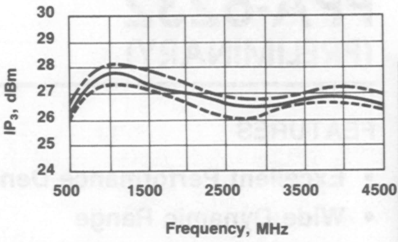
WEIGHT: (typical) 0.5 grams



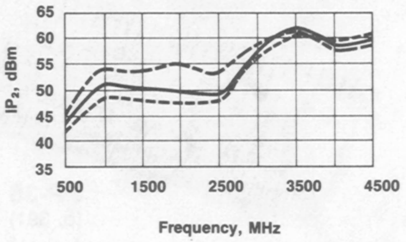
Input VSWR



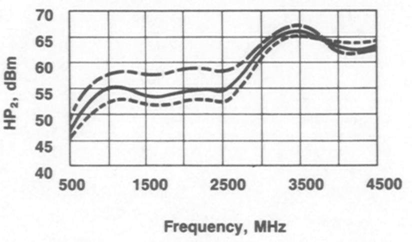
Output VSWR



Third-Order Intercept Point



Second-Order Intercept Point



Second-Harmonic Intercept Point

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

LINAEARIZATION RANGE: 1000 TO 4000

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
250.00	.206	–67.84	14.61	139.6	–56.28	122.0	.746	147.67
500.00	.127	–106.00	21.79	63.0	–49.55	67.0	.320	117.88
750.00	.107	–110.26	22.69	32.5	–49.17	51.5	.179	117.57
1000.00	.110	–112.30	22.92	14.4	–49.34	46.6	.123	116.64
1250.00	.122	–114.72	22.99	2.4	–49.67	44.1	.096	104.64
1500.00	.136	–118.14	23.04	–8.8	–50.28	43.7	.089	82.24
1750.00	.149	–122.94	23.02	–17.1	–50.80	46.8	.103	60.68
2000.00	.168	–133.90	22.95	–23.8	–51.71	48.3	.136	50.43
2250.00	.179	–141.20	22.86	–32.4	–52.95	51.7	.161	41.42
2500.00	.179	–150.18	22.82	–38.7	–53.62	55.9	.186	35.98
2750.00	.168	–162.98	22.78	–45.4	–55.10	58.4	.206	34.01
3000.00	.148	–177.69	22.84	–51.8	–56.20	65.4	.218	30.06
3250.00	.119	158.39	22.89	–58.2	–58.16	68.0	.224	29.01
3500.00	.093	121.10	22.92	–65.4	–60.44	74.5	.212	25.76
3750.00	.099	71.51	23.12	–72.8	–63.34	108.9	.192	22.39
4000.00	.132	32.72	23.23	–81.7	–63.47	141.3	.155	14.34
4250.00	.172	5.85	23.51	–91.3	–58.54	171.6	.100	–8.84
4500.00	.195	–14.86	23.57	–102.0	–55.23	175.1	.080	–89.70
4750.00	.197	–29.30	23.39	–116.0	–52.15	178.4	.196	–141.42
5000.00	.187	–43.04	22.94	–131.3	–49.93	172.2	.346	–163.59
5250.00	.164	–53.74	21.80	–144.9	–49.32	166.1	.463	–179.60
5500.00	.132	–68.07	20.24	–158.0	–47.41	175.6	.519	170.55
5750.00	.085	–71.21	18.73	–168.3	–46.22	161.3	.537	161.89
6000.00	.065	–62.02	17.13	–175.8	–47.79	150.2	.490	155.84
6250.00	.053	–54.35	15.22	176.7	–51.34	–179.7	.408	156.12
6500.00	.054	–42.47	13.59	172.0	–50.22	–138.2	.333	158.13
6750.00	.081	–33.45	12.53	168.3	–44.31	–152.3	.297	153.72
7000.00	.115	–46.64	11.26	161.4	–43.32	–161.1	.200	139.48
7250.00	.138	–59.35	9.93	156.0	–45.20	–167.6	.122	109.06
7500.00	.163	–70.47	8.55	148.3	–47.16	–155.3	.131	53.87
7750.00	.186	–78.25	7.32	142.5	–47.74	–140.9	.207	33.56
8000.00	.205	–86.12	5.70	134.4	–48.95	–132.8	.304	26.50

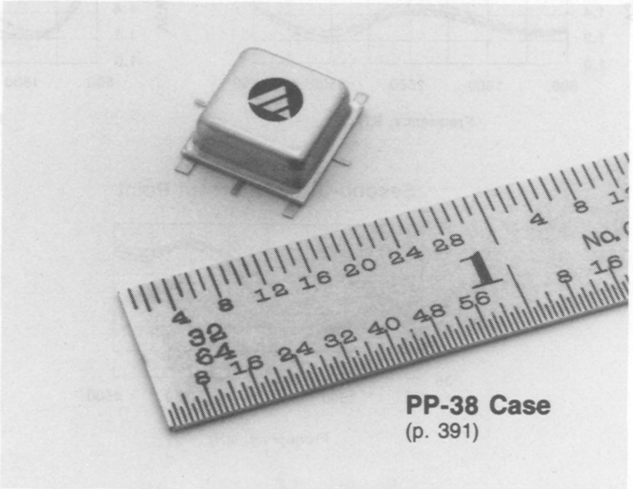
PPA-6232
(PRELIMINARY)

Surface Mount Amplifier 2000-6000 MHz

AVANTEK

FEATURES

- Excellent Performance Density
- Wide Dynamic Range
- Full 2-6 GHz Frequency Coverage
- PlanarPak™ Surface Mount Package


PP-38 Case
(p. 391)

ELECTRICAL SPECIFICATIONS[P] (Measured in a 50-ohm system @ +8 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°-50°C$	$T_C = -55°- +85°C$	Unit
BW	Frequency Range	1500-6000	2000-6000	2000-6000	MHz
GP	Small Signal Gain	20.0	18.0 Min.	17.0 Min.	dB
—	Gain Flatness	±0.3	±1.0 Max.	±1.5 Max.	dB
NF	Noise Figure	4.3	5.5 Max.	7.0 Max.	dB
$P_{1 dB}$	Power Output @ +1 dB Compression	+19.0	+17.0 Min.	+16.0 Min.	dBm
—	Input VSWR	1.6:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR	1.6:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+27.0	—	—	dBm
IP_2	Two Tone 2nd Order Intercept Point	+45.0	—	—	dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+51.0	—	—	dBm
I_D	DC Current	150	—	—	mA

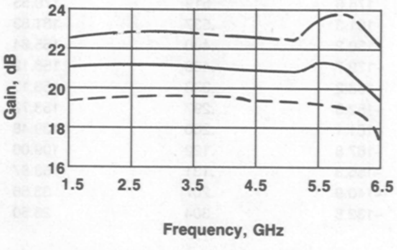
(P) Preliminary

TYPICAL PERFORMANCE OVER TEMPERATURE (@ +8 VDC unless otherwise noted)

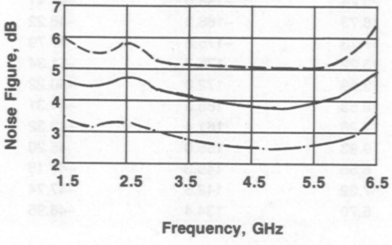
KEY:

+25°C	———
+85°C	— — —
−55°C	—·—·—

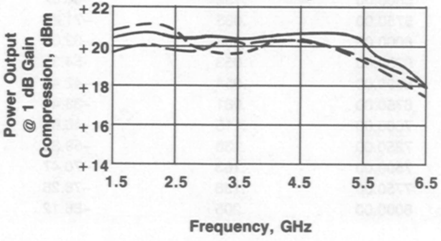
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage	+9 Volts
Continuous RF Input Power	+15 dBm
Operating Case Temperature	−55°C to +100°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+100°C

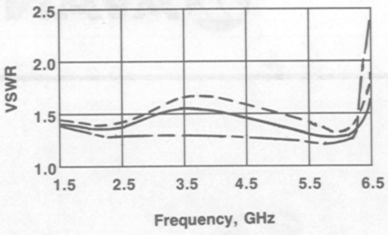
THERMAL CHARACTERISTICS*

θ_{JC}	100°C/W
Active Transistor Power Dissipation	420 mW
Junction Temperature Above Case Temperature	42°C

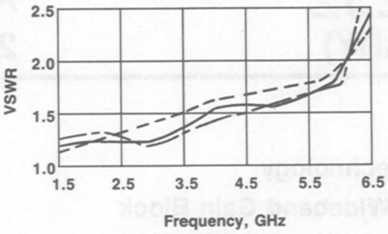
*For further information, see High Reliability section.

WEIGHT: (typical) 0.5 grams

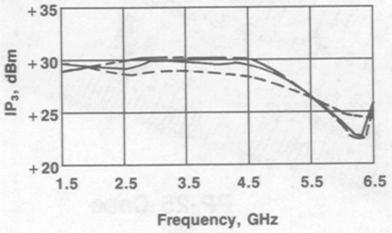
Input VSWR



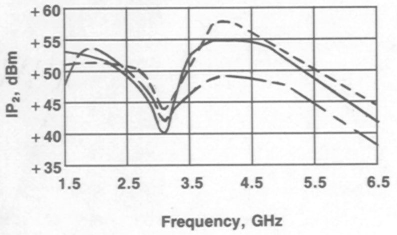
Output VSWR



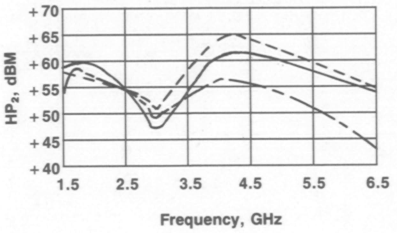
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

S-PARAMETERS, MAGNITUDES AND ANGLES **BIAS = 15.00 VOLTS**

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
250.00	.77	–45.0	–4.7	–132.9	–38.5	–44.1	.95	–38.43
500.00	.50	–70.3	11.8	149.3	–49.1	–70.5	.90	–86.06
750.00	.35	–82.1	18.5	78.7	–46.9	43.6	.54	–139.31
1000.00	.28	–90.3	20.2	26.2	–40.5	19.8	.19	–170.41
1250.00	.22	–98.3	20.5	–10.3	–38.6	.5	.06	–142.41
1500.00	.17	–101.7	20.7	–39.1	–37.4	–16.2	.07	–102.95
1750.00	.13	–97.2	20.8	–64.1	–36.9	–31.9	.08	–109.88
2000.00	.12	–85.4	20.9	–87.3	–36.6	–47.0	.08	–118.82
2250.00	.13	–75.8	20.9	–109.3	–36.6	–61.1	.07	–122.55
2500.00	.16	–76.9	20.9	–130.2	–36.3	–75.5	.05	–121.01
2750.00	.19	–83.3	20.9	–150.6	–36.5	–88.9	.05	–95.67
3000.00	.21	–94.2	20.9	–170.5	–36.7	–102.4	.07	–68.22
3250.00	.22	–107.3	20.8	170.1	–36.9	–116.9	.10	–58.24
3500.00	.23	–122.6	20.7	150.8	–37.3	–131.4	.14	–57.24
3750.00	.23	–140.3	20.6	131.8	–37.4	–145.5	.18	–58.46
4000.00	.22	–159.8	20.5	113.2	–37.8	–158.1	.19	–59.87
4250.00	.20	178.6	20.4	94.9	–37.8	–170.4	.22	–64.49
4500.00	.18	153.7	20.4	76.1	–38.2	177.2	.23	–72.62
4750.00	.17	125.5	20.4	57.4	–38.6	166.1	.22	–82.89
5000.00	.16	96.5	20.5	37.6	–38.4	155.4	.21	–102.41
5250.00	.17	70.0	20.5	17.3	–38.7	145.6	.17	–122.94
5500.00	.18	43.5	20.5	–2.5	–38.3	149.1	.15	–146.99
5750.00	.15	17.0	21.0	–25.4	–36.7	131.0	.20	175.83
6000.00	.08	17.3	20.9	–53.0	–36.3	109.4	.24	129.48
6250.00	.09	87.8	20.5	–81.6	–36.0	92.9	.32	96.82
6500.00	.29	83.6	18.9	–115.0	–36.9	62.6	.44	65.64
6750.00	.46	59.2	16.1	–142.2	–39.6	37.3	.50	39.13
7000.00	.56	40.5	12.9	–161.5	–43.9	12.7	.54	23.00
7250.00	.62	26.8	10.1	–175.0	–48.3	–22.4	.55	13.05
7500.00	.67	16.4	7.7	174.6	–47.9	–74.9	.57	4.00
7750.00	.69	8.3	5.7	166.4	–44.6	–110.6	.59	–.75
8000.00	.71	1.7	4.2	158.7	–39.8	–123.1	.59	–4.25
8250.00	.72	–4.1	2.9	150.8	–35.5	–132.0	.59	–9.46
8500.00	.73	–9.4	1.9	143.1	–30.9	–138.9	.59	–12.13
8750.00	.73	–14.3	1.0	135.1	–26.0	–149.0	.58	–14.03
9000.00	.72	–18.7	.3	126.3	–20.7	–163.6	.55	–19.42

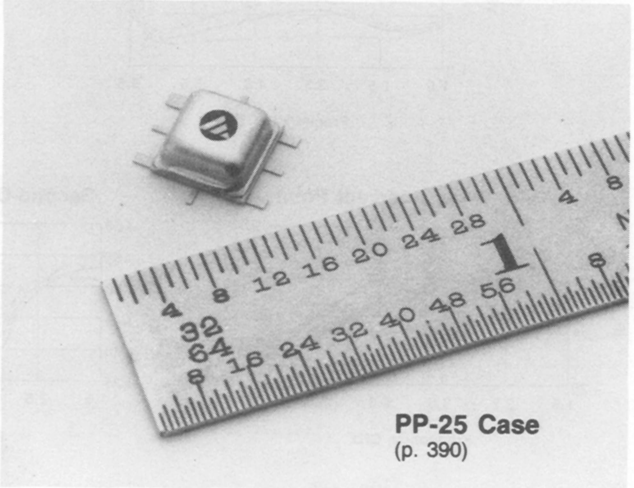
PPA-18232
(PRELIMINARY)

Surface Mount Amplifier 2-18 GHz

AVANTEK

FEATURES

- **GaAs MMIC Technology**
- **High Density Wideband Gain Block**
- **Full 2-18 GHz Frequency Coverage**
- **PlanarPak™ Surface Mount Package**


PP-25 Case
(p. 390)

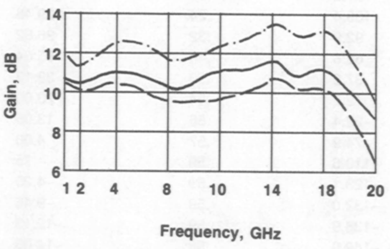
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +8 VDC nominal unless otherwise noted)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	Unit
BW	Frequency Range	2–18	2–18	2–18	GHz
GP	Small Signal Gain	11.0	9.0 Min.	8.0 Min.	dB
—	Gain Flatness	±1.0	±2.0 Max.	±2.0 Max.	dB
NF	Noise Figure, $V_{AGC} = 0$	7.5	9.5 Max.	11.0 Max.	dB
$P_{1\,dB}$	Power Output at 1 dB Compression	+13.0	+11.0 Max.	+9.0 Max.	dBm
—	Input VSWR	1.8:1	2.2:1 Max.	2.2:1 Max.	—
—	Output VSWR	1.8:1	2.2:1 Max.	2.2:1 Max.	
IP_3	Two Tone 3rd Order Intercept Point	+24			dBm
IP_2	Two Tone 2nd Order Intercept Point	+30			dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+36			dBm
I_D	DC Current	155			mA

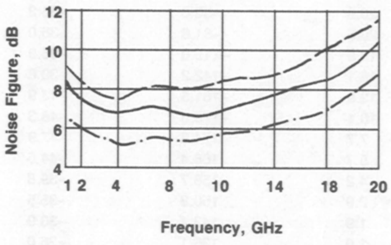
TYPICAL PERFORMANCE OVER TEMPERATURE (@ +8 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
-55°C —·—·—

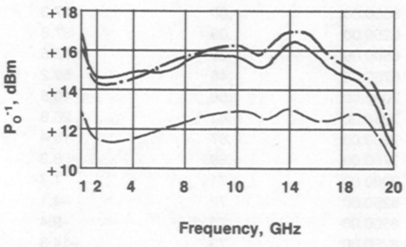
Gain



Noise Figure



Power Output



MAXIMUM RATINGS

DC Voltage	+9 Volts
Continuous RF Input Power	+15 dBm
Operating Case Temperature	-55°C to +100°C
Storage Temperature	-62°C to +150°C
"R" Series Burn-In Temperature	+100°C

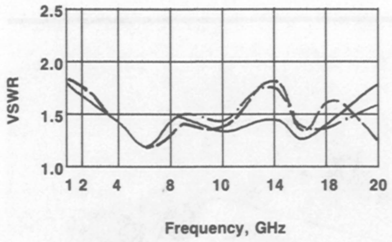
THERMAL CHARACTERISTICS*

θ_{JC}	40°C/W
Active Transistor Power Dissipation	410 mW
Junction Temperature Above Case Temperature	16°C

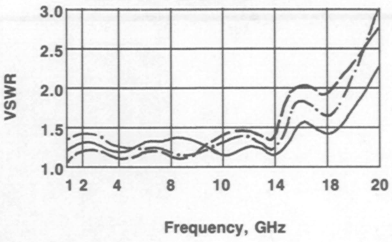
*For further information, see High Reliability section.

WEIGHT: (typical) .21 grams

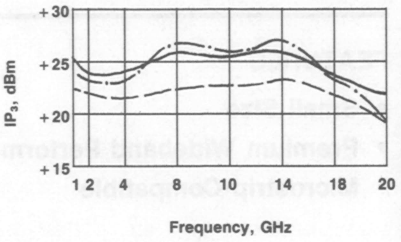
Input VSWR vs. Frequency



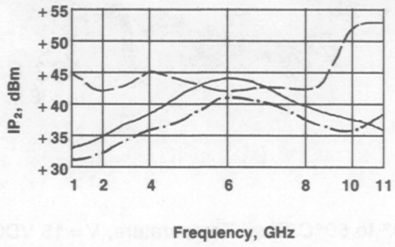
Output VSWR vs. Frequency



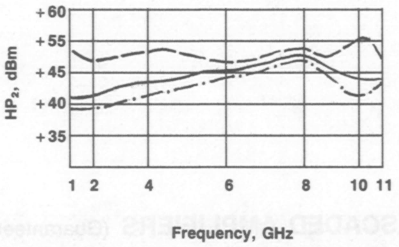
Third-Order Intercept Point



Second-Order Intercept Point



Second Harmonic Intercept Point



AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 8.00 VOLTS

FREQ	11		21		12		22	
GHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
.500	.42	–63.8	–9.4	–56.3	–84.7	91.3	.74	–147.04
1.000	.31	–69.7	11.1	112.8	–75.3	89.6	.13	–8.77
1.500	.28	–80.7	10.7	26.4	–62.3	135.4	.17	–84.42
2.000	.26	–90.0	10.5	–21.3	–59.7	80.4	.15	–116.19
2.500	.24	–98.3	10.6	–58.1	–57.8	45.6	.13	–130.05
3.000	.23	–105.4	10.8	–90.7	–63.3	4.9	.09	–126.20
3.500	.20	–113.6	11.2	–122.1	–68.1	136.1	.05	–95.84
4.000	.17	–119.6	11.3	–152.4	–55.1	67.3	.05	–14.54
4.500	.14	–127.3	11.4	177.8	–53.5	30.6	.08	7.66
5.000	.10	–146.0	11.2	148.6	–57.2	–17.5	.10	20.34
5.500	.06	–176.2	10.9	121.5	–60.4	1.4	.13	18.93
6.000	.05	120.1	10.7	95.4	–61.3	–12.1	.14	13.47
6.500	0.9	84.1	10.4	70.1	–65.0	–2.9	.16	6.14
7.000	.13	70.4	10.2	45.8	–60.4	51.9	.16	.50
7.500	.17	61.8	10.1	22.4	–57.4	14.8	.16	–5.52
8.000	.19	56.0	10.1	–1.4	–55.7	–9.3	.16	–13.46
8.500	.20	52.0	10.2	–25.5	–61.2	–22.9	.14	–21.39
9.000	.19	48.8	10.3	–49.7	–59.3	–1.2	.11	–34.02
9.500	.16	44.1	10.6	–74.8	–60.1	–8.7	.08	–68.00
10.000	.12	35.6	10.7	–100.7	–60.1	34.4	.11	–109.12
11.000	.08	–21.6	10.8	–152.4	–57.4	27.5	.19	–116.23
12.000	.15	–58.8	11.0	155.0	–48.2	–1.1	.14	–97.74
13.000	.18	–47.5	11.6	100.8	–46.3	–57.2	.12	–79.50
14.000	.19	–31.4	11.7	40.9	–46.8	–88.8	.06	–94.45
15.000	.14	–32.5	11.4	–19.1	–43.9	–108.0	.09	113.27
16.000	.07	–126.6	10.8	–80.1	–41.4	–170.1	.24	142.87
17.000	.14	–154.5	10.7	–138.3	–39.5	119.9	.16	166.74
18.000	.19	–141.7	11.5	154.2	–33.3	50.5	.18	–177.08
19.000	.22	–170.2	10.7	74.6	–31.7	–13.0	.38	128.69
20.000	.28	139.0	8.6	–2.8	–29.4	–71.1	.40	95.74
21.000	.44	131.7	4.7	–80.5	–26.9	–133.8	.54	129.62
22.000	.67	158.1	3.2	–165.8	–32.8	–148.8	.56	137.46
23.000	.59	149.5	–3.2	122.5	–24.8	137.6	.19	153.61
24.000	.47	–179.5	–7.6	88.1	–29.7	41.2	.39	–143.92
25.000	.54	–160.4	–12.9	4.7	–35.1	44.9	.57	–144.68

PORT EXTENSIONS: S11 = 29.90 (mm), S21 = 29.90, S12 = 52.90, S22 = 52.90

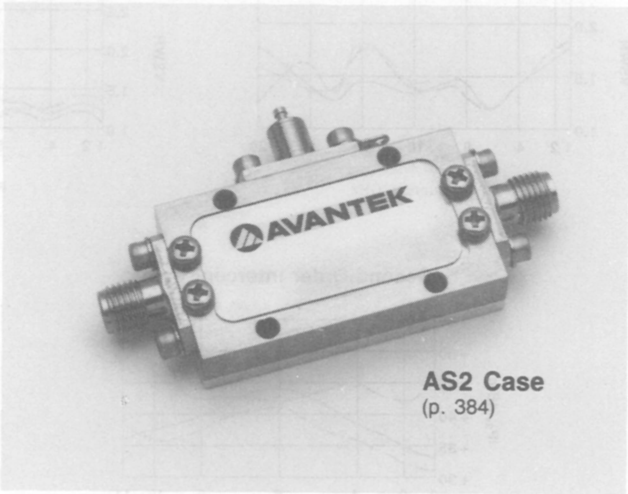
ACT Series

Avanpak
Cascaded Amplifiers
10-2000 MHz

AVANTEK

FEATURES

- **Small Size**
- **Premium Wideband Performance**
- **Microstrip Compatible**



AS2 Case
(p. 384)

ACT SERIES CASCADED AMPLIFIERS (Guaranteed Specifications @ 0° to 50°C Case Temperature, V = 15 VDC)

10 to 500 MHz

Model #	Frequency Range MHz	Gain (dB) Typ./Min.	Noise Figure (dB) Max.	Power Output for 1 dB Gain Compression (dBm) Min.	Gain Flatness (±dB) Max.	3rd Order Intercept Point (dBm) Typ.	VSWR 50 ohms Max. In/Out	Input Bias Current (mA) Typ.	Case Type
ACT5-200	10–500	26.5/25	2.7	+6	±1.5	+22	2.0:1	35	AS2
ACT5-201	10–500	37/35	2.7	+7	±1.5	+20	2.0:1	33	AS2
ACT5-202	10–500	51.5/49	2.7	+6	±1.5	+18	2.0:1	60	AS2
ACT5-203	10–500	64.5/62	2.7	+6	±2.0	+18	2.0:1	70	AS2
ACT5-210	10–500	27.5/26	3.0	+14	±1.5	+30	2.0:1	78	AS2
ACT5-211	10–500	38/36	3.5	+14	±1.5	+30	2.0:1	76	AS2
ACT5-212	10–500	47/45	2.7	+14	±1.5	+27	2.0:1	80	AS2
ACT5-213	10–500	54/52	2.7	+14	±2.0	+27	2.0:1	92	AS2
ACT5-214	10–500	67/65	2.7	+14	±2.0	+27	2.0:1	103	AS2
ACT5-220	10–500	24.5/23	3.5	+23	±1.5	+35	2.0:1	165	AS2
ACT5-221	10–500	35/33	3.0	+23	±2.0	+35	2.0:1	190	AS2
ACT5-222	10–500	46/44	3.0	+23	±2.0	+35	2.0:1	193	AS2
ACT5-223	10–500	60.5/58	3.0	+23	±2.0	+35	2.0:1	210	AS2

10 to 1000 MHz

Model #	Frequency Range MHz	Gain (dB) Typ./Min.	Noise Figure (dB) Max.	Power Output for 1 dB Gain Compression (dBm) Min.	Gain Flatness (±dB) Max.	3rd Order Intercept Point (dBm) Typ.	VSWR 50 ohms Max. In/Out	Input Bias Current (mA) Typ.	Case Type
ACT10-210	10–1000	21.5/20	4.5	+11	±2.0	+28	2.0:1	60	AS2
ACT10-211	10–1000	31/29	3.7	+9	±1.5	+20	2.0:1	37	AS2
ACT10-212	10–1000	41/39	3.7	+9	±2.0	+20	2.0:1	62	AS2
ACT10-213	10–1000	52/50	3.7	+12	±2.0	+27	2.0:1	101	AS2
ACT10-220	10–1000	22.5/21	5.0	+20	±1.5	+35	2.0:1	125	AS2
ACT10-221	10–1000	33/31	4.5	+20	±2.0	+35	2.0:1	150	AS2
ACT10-222	10–1000	42/40	3.7	+20	±2.0	+35	2.0:1	127	AS2
ACT10-223	10–1000	49/47	3.7	+20	±2.0	+35	2.0:1	163	AS2

10 to 2000 MHz

Model #	Frequency Range MHz	Gain (dB) Typ./Min.	Noise Figure (dB) Max.	Power Output for 1 dB Gain Compression (dBm) Min.	Gain Flatness (±dB) Max.	3rd Order Intercept Point (dBm) Typ.	VSWR 50 ohms Max. In/Out	Input Bias Current (mA) Typ.	Case Type
ACT20-210	10–2000	19.5/18	5.0	+7	±1.5	+17	2.2:1	41	AS2
ACT20-211	10–2000	28/26	5.0	+14	±2.0	+29	2.2:1	91	AS2
ACT20-212	10–2000	34/32	6.0	+14	±2.0	+29	2.2:1	104	AS2
ACT20-213	10–2000	40/38	6.0	+12	±2.0	+29	2.2:1	126	AS2

WEIGHT: (typical) AS2 = 40 grams

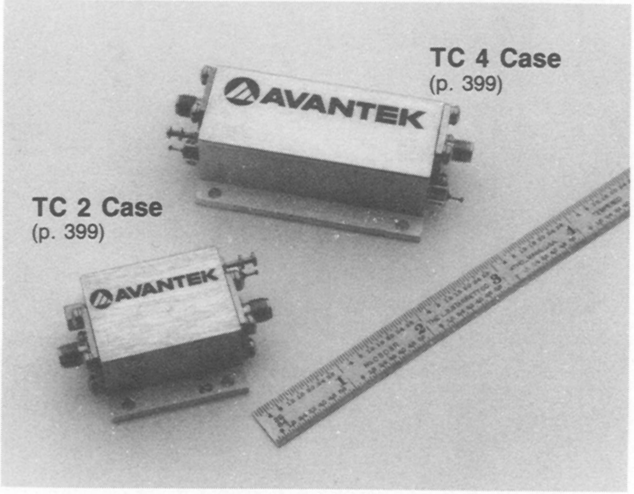
NOTES:

UTC Series

Modular Cascaded Amplifiers 10-2000 MHz

FEATURES

- **Low Noise**
- **Modular Packaged**
- **Coax Connectors**



UTC SERIES MODULAR CASCADED AMPLIFIERS (Guaranteed Specifications @ 0° to 50°C Case Temperature, V = 15 VDC)

Model #	Frequency Range MHz	Gain (dB) Typ./Min.	Noise Figure (dB) Max.	Power Output for 1 dB Gain Compression (dBm) Min.	Gain Flatness (±dB) Max.	3rd Order Intercept Point (dBm) Typ.	VSWR 50 ohms Max. In/Out	Input Bias Current (mA) Typ.	Case Type
10 to 500 MHz									
UTC5-200	10–500	26.5/25	2.7	+6	±1.5	+22	2.0:1	35	TC2
UTC5-201	10–500	37/35	2.7	+7	±1.5	+20	2.0:1	33	TC2
UTC5-202	10–500	51.5/48	2.7	+6	±1.5	+18	2.0:1	60	TC2
UTC5-203	10–500	64.5/62	2.7	+6	±2.0	+18	2.0:1	70	TC4
UTC5-210	10–500	27.5/26	3.0	+14	±1.5	+30	2.0:1	78	TC2
UTC5-211	10–500	38/36	3.5	+14	±1.5	+30	2.0:1	76	TC2
UTC5-212	10–500	47/45	2.7	+14	±1.5	+27	2.0:1	80	TC2
UTC5-213	10–500	54/52	2.7	+14	±2.0	+27	2.0:1	92	TC2
UTC5-214	10–500	67/65	2.7	+14	±2.0	+27	2.0:1	103	TC4
UTC5-220	10–500	24.5/23	3.5	+23	±1.5	+35	2.0:1	165	TC2
UTC5-221	10–500	35/33	3.0	+23	±2.0	+35	2.0:1	190	TC4
UTC5-222	10–500	46/44	3.0	+23	±2.0	+35	2.0:1	193	TC4
UTC5-223	10–500	60.5/58	3.0	+23	±2.0	+35	2.0:1	210	TC4
10 to 1000									
UTC10-210	10–1000	21.5/20	4.5	+11	±2.0	+28	2.0:1	60	TC2
UTC10-211	10–1000	31/29	3.7	+9	±1.5	+20	2.0:1	37	TC2
UTC10-212	10–1000	41/39	3.7	+9	±2.0	+20	2.0:1	62	TC4
UTC10-213	10–1000	52/50	3.7	+12	±2.0	+27	2.0:1	101	TC4
UTC10-220	10–1000	22.5/21	5.0	+20	±1.5	+35	2.0:1	125	TC2
UTC10-221	10–1000	33/31	4.5	+20	±2.0	+35	2.0:1	150	TC2
UTC10-222	10–1000	42/40	3.7	+20	±2.0	+35	2.0:1	127	TC4
UTC10-223	10–1000	49/47	3.7	+20	±2.0	+35	2.0:1	163	TC4
10 to 2000 MHz									
UTC20-210	10–2000	19.5/18	5.0	+7	±1.5	+17	2.2:1	41	TC2
UTC20-211	10–2000	28/26	5.0	+14	±2.0	+29	2.2:1	91	TC4
UTC20-212	10–2000	34/32	6.0	+14	±2.0	+29	2.2:1	104	TC4
UTC20-213	10–2000	40/38	6.0	+12	±2.0	+29	2.2:1	126	TC4

WEIGHT: (typical) TC2 = 57 grams; TC4 = 114 grams

NOTES:

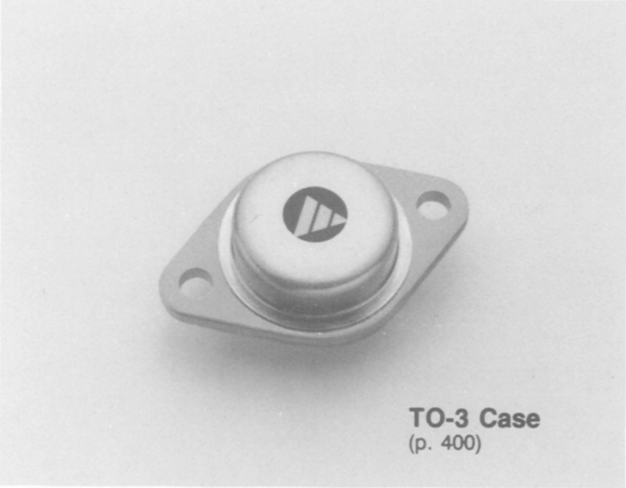
AGC-330

Voltage Controlled AGC Amplifier 5-300 MHz

AVANTEK

FEATURES

- **Complete AGC Amplifier in Single Package**
- **Wide AGC Range: 36 dB**
- **Temperature Stable AGC Range When Current Sourced Control**



TO-3 Case
(p. 400)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	Unit
BW	Frequency Range	5–300	5–300	MHz
GP	Small Signal Gain @0 V_C	22	20 Min.	dB
—	Gain Flatness	±0.7	±1.0 Max.	—
—	AGC Range	36	30 Min.	dB
NF	Noise Figure—no AGC	4.0	5.0 Max.	dB
$P_{1\ dB}$	Power Output at 1 dB Compression no AGC	+1.0	0	dBm
—	Input VSWR	1.7:1	2.0:1 Max.	—
—	Output VSWR	1.5:1	2.0:1 Max.	—
—	Response Time	1.5	2.0 Max.	μsec
VDC	Bias Voltage	+15		Volts
I_D	Bias Current	25	30 Max.	mA
V_{AGC}	AGC Voltage	0–5		Volts
I_{AGC}	AGC Current	0-60		mA

WEIGHT: (typical) 14.5 grams

NOTES:

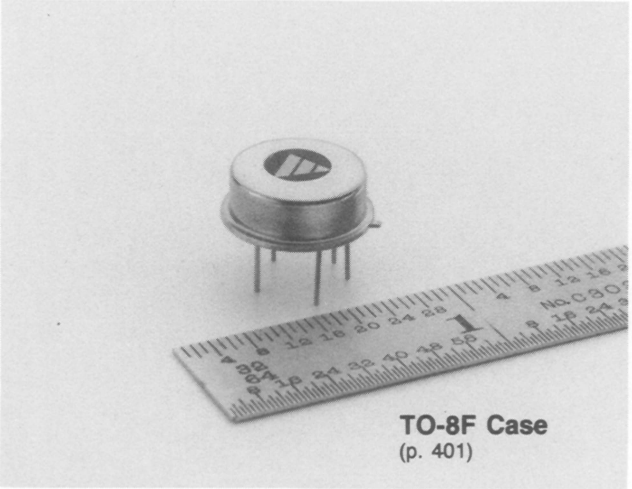
AGC-553

Voltage Controlled
AGC Amplifier
10-500 MHz

AVANTEK

FEATURES

- **MODAMP™ Silicon Monolithic Gain Stages**
- **45 dB AGC Range**
- **5 Volt, TTL Compatible Control Voltage**



TO-8F Case
(p. 401)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C=25°C$	Guaranteed Specifications $T_C=0°$ to $50°C$	Guaranteed Specifications $T_C=-55°$ to $+85°C$	Unit
BW	Frequency Range	10–500	10–500	10–500	MHz
GP	Small Signal Gain	44	40 Min.	40 Min.	dB
—	Gain Flatness, $V_{AGC}=0$ to $+5$ Volts	±2.0	±3.0 Max.	±3.0 Max.	dB
—	AGC Range	45			dB
NF	Noise Figure, $V_{AGC}=0$	6.0	8.0 Max.	9.0 Max.	dB
$P_{1\,dB}$	Power Output at 1 dB Compression $V_{AGC}=0$	0	−4.0	−6.0	dBm
—	Input VSWR, $V_{AGC}=0$ to $+5$ Volts	1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR, $V_{AGC}=0$ to $+5$ Volts	1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+12			dBm
IP_2	Two Tone 2nd Order Intercept Point	+12			dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+32			dBm
—	Response Time	25			µsec
VDC	Bias Voltage	+15			Volts
I_D	Bias Current	50			mA
V_{AGC}	AGC Voltage	0 to +5			Volts
I_{AGC}	AGC Current	0 to 12			mA

MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+17 dBm
Operating Case Temperature	−55°C to +100°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+100°C

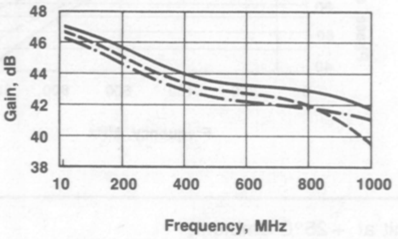
THERMAL CHARACTERISTICS

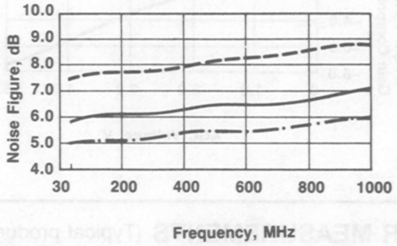
θ_{JC}	240/240/240°C/W
Active Transistor Power Dissipation	170/170/170 mW
Junction Temperature Above Case Temperature	41/41/41°C

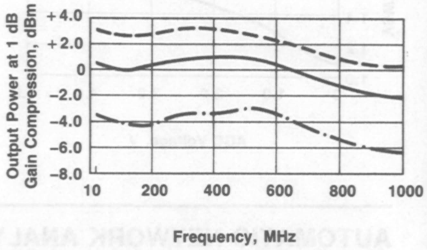
WEIGHT: (typical) 2.1 grams

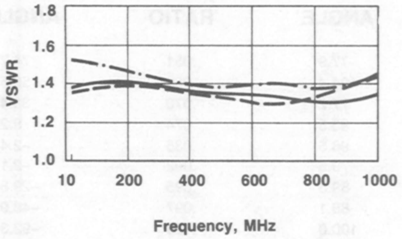
TYPICAL PERFORMANCE AT 25°C

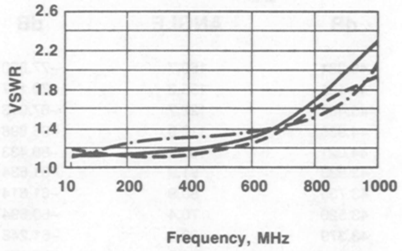
KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

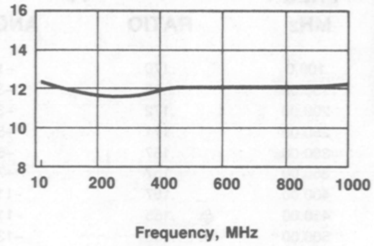

Gain

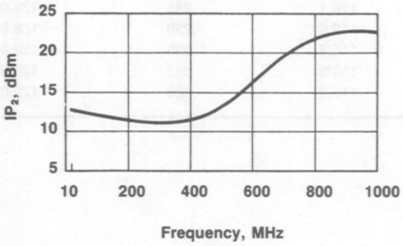

Noise Figure

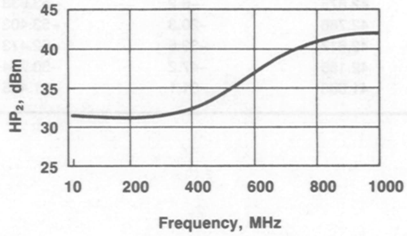

Output Power

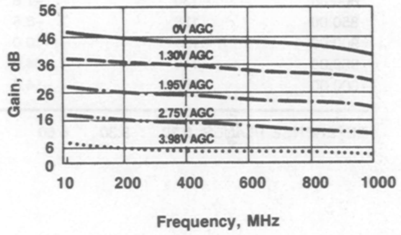

Input VSWR

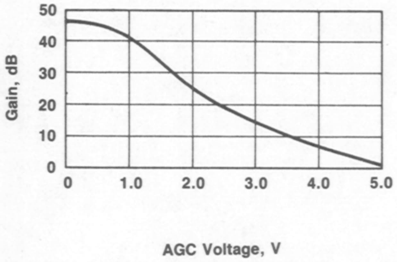

Output VSWR

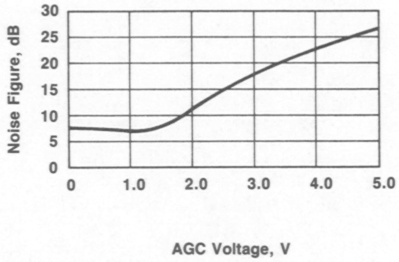

Third-Order Intercept Point

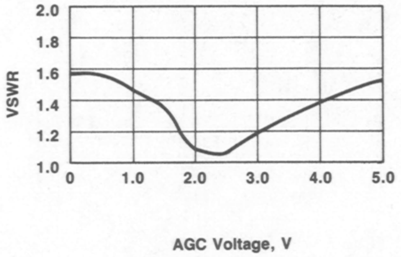

Second-Order Intercept Point


Second Harmonic


Gain at 10 dB AGC Steps

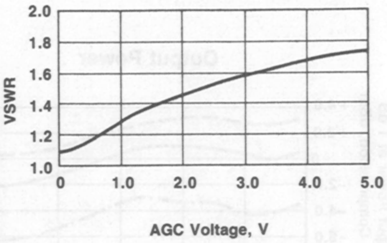

Gain at 250 MHz


Noise Figure at 250 MHz

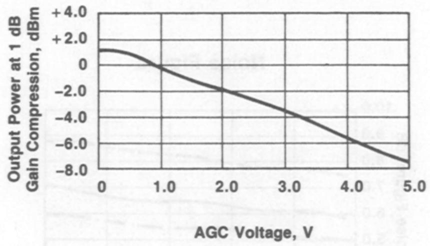

Input VSWR at 100 MHz

TYPICAL PERFORMANCE AT 25°C (continued)

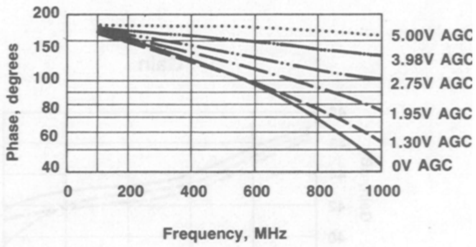
Output VSWR at 100 MHz



Output Power at 250 MHz



Phase



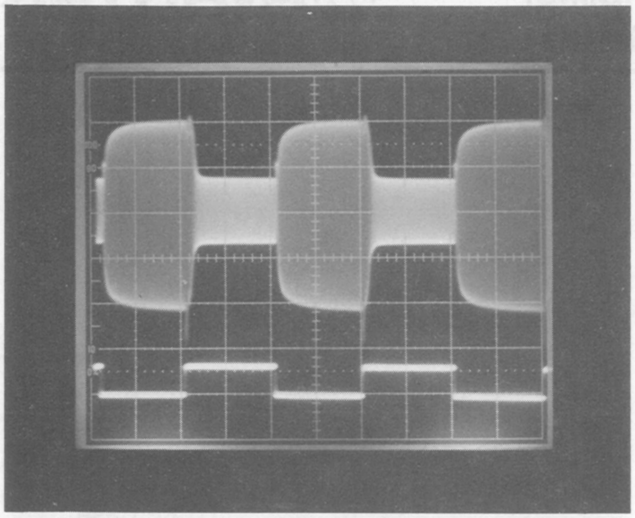
AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

S-PARAMETERS, MAGNITUDES AND ANGLES

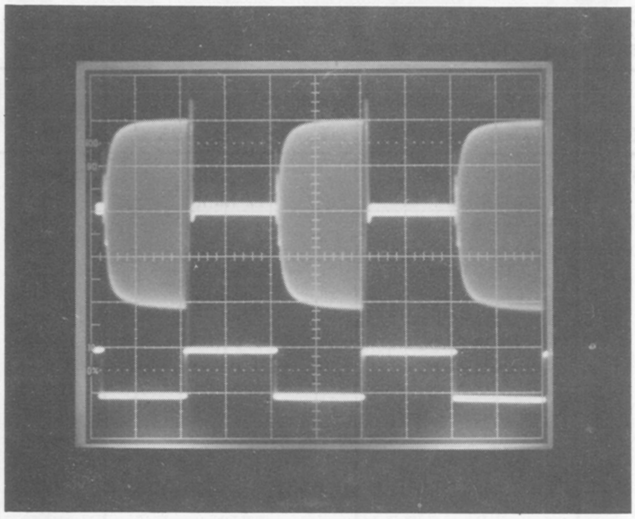
BIAS = 15.00 VOLTS
47mA

FREQ	11		21		12		22	
MHz	RATIO	ANGLE	dB	ANGLE	dB	ANGLE	RATIO	ANGLE
100.0	.170	−1.5	46.381	150.7	−77.830	−77.9	.051	74.7
150.00	1.78	−3.0	46.125	135.3	−70.117	104.4	.060	50.5
200.00	.172	−3.6	45.486	122.7	−67.013	77.2	.070	33.4
250.00	.171	−5.3	44.935	110.9	−65.898	93.5	.074	8.2
300.00	.157	−5.6	44.021	100.4	−60.433	96.5	.035	−2.4
350.00	.157	−7.1	43.933	91.9	−61.634	79.5	.092	−2.1
400.00	.157	−11.7	43.735	80.9	−61.614	89.5	.095	−29.8
450.00	.155	−11.5	43.520	70.4	−60.694	88.1	.097	−48.9
500.00	.155	−13.0	43.379	60.3	−61.248	100.0	.123	−92.3
550.00	.156	−14.4	43.217	50.2	−58.353	100.2	.123	−92.3
600.00	.151	−11.8	43.058	39.8	−58.173	104.1	.136	−110.4
650.00	.143	−6.5	42.897	29.4	−57.308	113.5	.161	−127.6
700.00	.132	−4.0	42.824	18.9	−56.308	112.0	.196	−145.2
750.00	.122	−6.2	42.785	6.6	−55.176	115.3	.221	−162.5
800.00	.130	−7.6	42.875	−6.2	−53.638	116.1	.245	−176.0
850.00	.128	−8.5	42.766	−20.3	−53.403	115.0	.298	168.8
900.00	.131	−10.0	42.617	−33.6	−52.473	115.8	.335	152.4
950.00	.140	−14.0	42.155	−47.2	−50.734	112.8	.352	136.5
1000.00	.157	−14.0	41.886	−61.1	−51.425	115.7	.386	122.0

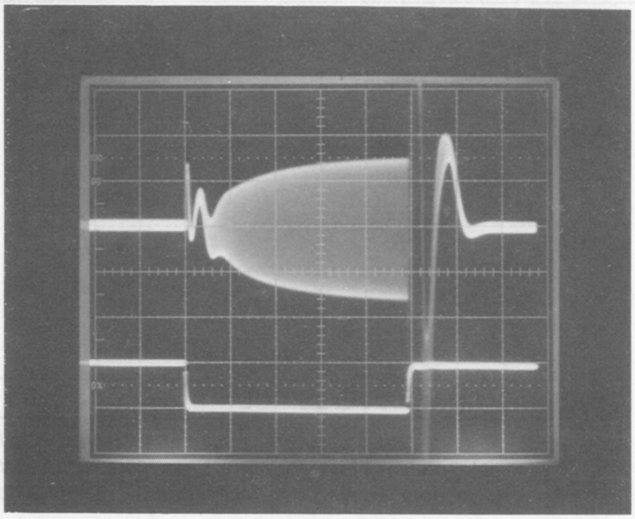
REFERENCE PLANES: 3.30 3.30 6.60



Frequency = 100 MHz
50 μSec./Div.
10 dB Gain Change



Frequency = 100 MHz
50 μSec./Div.
Full AGC Voltage



Frequency = 100 MHz
5 μSec./Div.
Full AGC Voltage

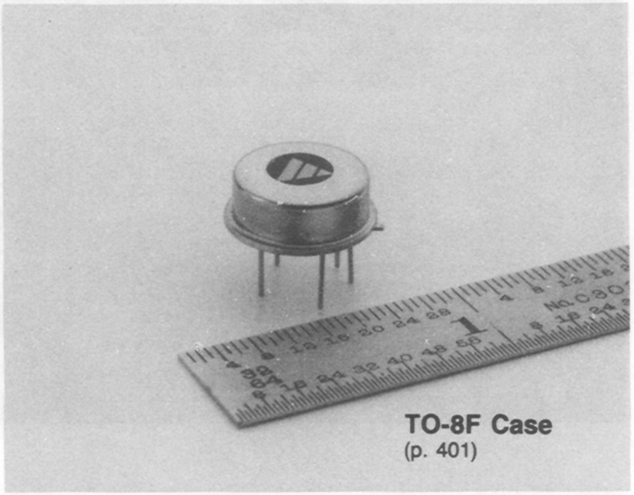
AGC-1053

Voltage Controlled AGC Amplifier 10-1000 MHz

AVANTEK

FEATURES

- **MODAMP™ Silicon Monolithic Gain Stages**
- **35 dB AGC Range**
- **5 Volt, TTL Compatible Control Voltage**



TO-8F Case
(p. 401)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	Unit
BW	Frequency Range	10–1000	10–1000	10–1000	MHz
GP	Small Signal Gain	22	18 Min.	17 Min.	dB
—	Gain Flatness, $V_{AGC} = 0$ to $+5$ Volts	±1.0	±2.0 Max.	±2.5 Max.	dB
—	AGC Range, $V_{AGC} = +5$ Volts	35			dB
NF	Noise Figure, $V_{AGC} = 0$	11.0	12.0 Max.	13.0 Max.	dB
$P_{1\,dB}$	Power Output at 1 dB Compression $V_{AGC} = 0$	+8.0	+5.0	+3.0	dBm
—	Input VSWR, $V_{AGC} = 0$ to $+5$ Volts	1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	Output VSWR, $V_{AGC} = 0$ to $+5$ Volts	1.5:1	2.0:1 Max.	2.0:1 Max.	—
IP_3	Two Tone 3rd Order Intercept Point	+20			dBm
IP_2	Two Tone 2nd Order Intercept Point	+40			dBm
HP_2	One Tone 2nd Harmonic Intercept Point	+50			dBm
—	Response Time (10 to 90%)	25			μsec
VDC	Bias Voltage	+15			Volts
I_D	Bias Current	90			mA
V_{AGC}	AGC Voltage	0 to +5			Volts
I_{AGC}	AGC Current	0 to 12			mA

MAXIMUM RATINGS

DC Voltage	+17 Volts
Continuous RF Input Power	+17 dBm
Operating Case Temperature	–55°C to +71°C
Storage Temperature	–62°C to +150°C
"R" Series Burn-In Temperature	+71°C

THERMAL CHARACTERISTICS

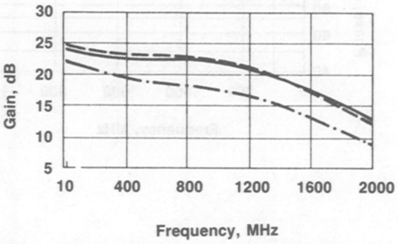
θ_{JC}	240/240/240°C/W
Active Transistor Power Dissipation	250/250/250 mW
Junction Temperature Above Case Temperature	60/60/84°C

WEIGHT: (typical) 2.1 grams

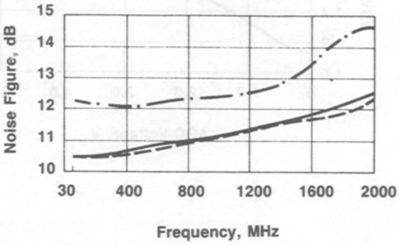
TYPICAL PERFORMANCE AT 25°C

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

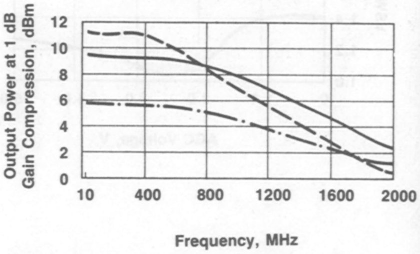
Gain



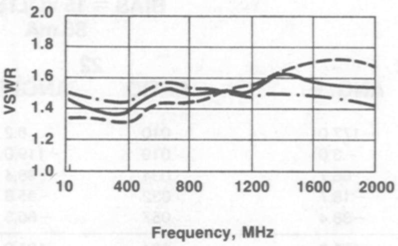
Noise Figure



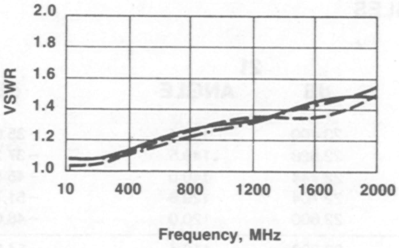
Output Power



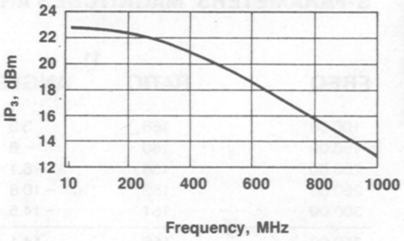
Input VSWR



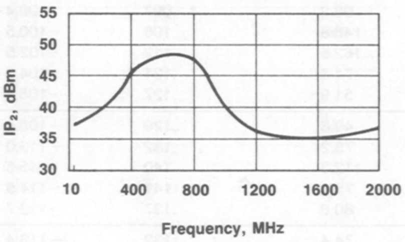
Output VSWR



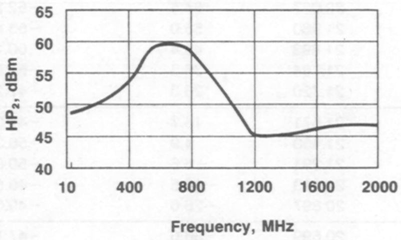
Third-Order Intercept Point



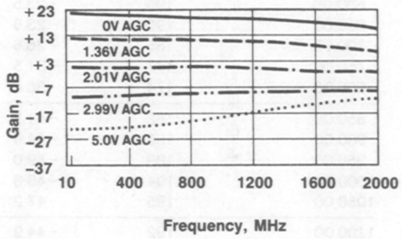
Second-Order Intercept Point



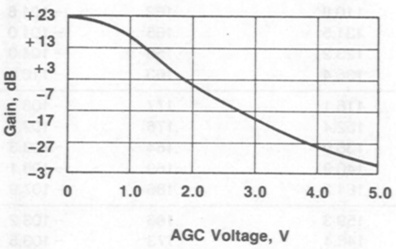
Second Harmonic



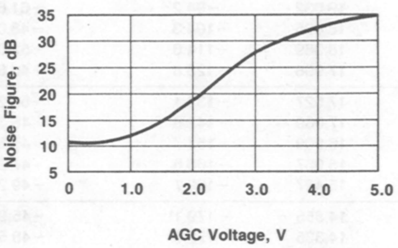
Gain at 10 dB AGC Series



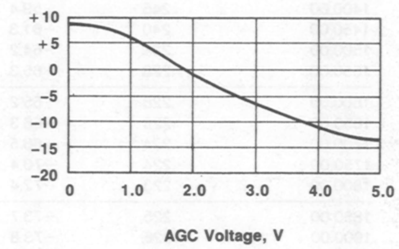
Gain at 500 MHz



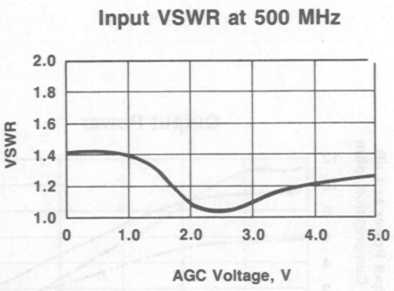
Noise Figure at 500 MHz

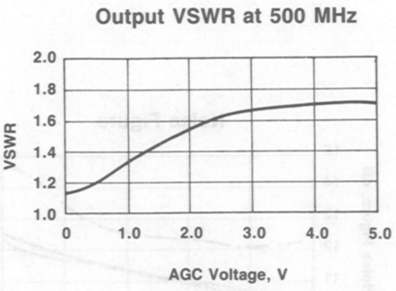


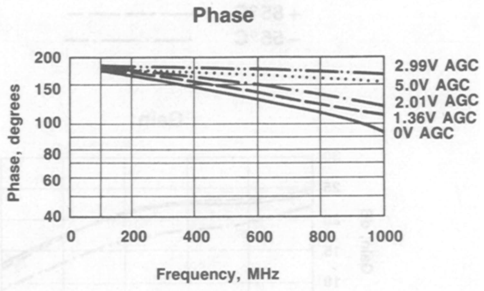
Output Power at 500 MHz



TYPICAL PERFORMANCE AT 25°C (continued)


Input VSWR at 500 MHz


Output VSWR at 500 MHz


Phase

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at +25°C ambient)

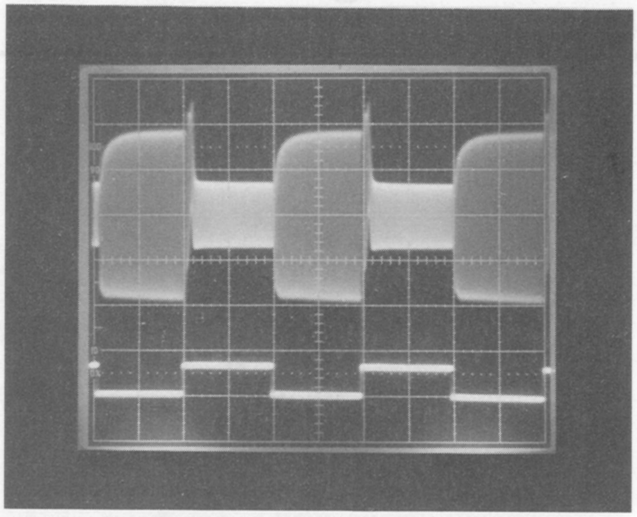
AGC-1053

S-PARAMETERS, MAGNITUDES AND ANGLES

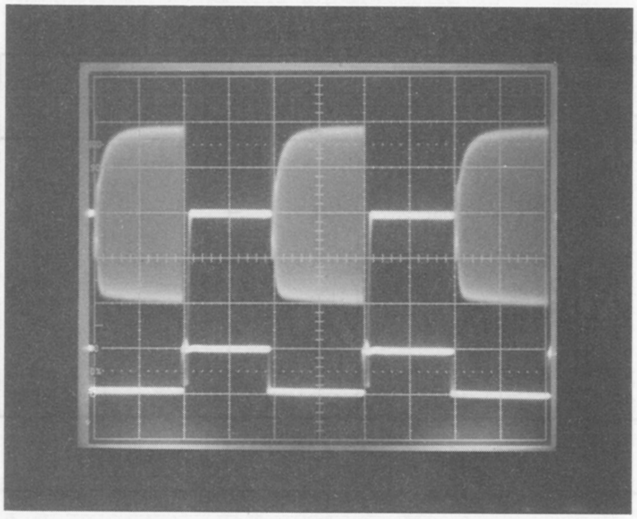
BIAS = 15 VOLTS
86 mA

	11		21		12		22	
FREQ	**RATIO**	**ANGLE**	**dB**	**ANGLE**	**dB**	**ANGLE**	**RATIO**	**ANGLE**
100.00	.168	3.3	23.100	160.4	−35.047	−177.0	.010	8.2
150.00	.160	−.8	22.828	149.5	−37.208	−3.0	.019	−119.0
200.00	.156	−6.1	22.744	140.0	−45.836	66.7	.034	−98.4
250.00	.152	−10.8	22.704	129.6	−51.764	−18.7	.032	−95.8
300.00	.151	−14.5	22.600	120.0	−48.073	−38.4	.057	−80.3
350.00	.156	−14.1	22.320	110.4	−54.909	−171.3	.064	−101.6
400.00	.158	−18.4	22.243	101.3	−45.695	40.0	.065	−97.3
450.00	.171	−22.4	22.115	92.3	−50.204	20.9	.075	−96.9
500.00	.185	−23.0	22.112	82.9	−53.132	145.6	.078	−96.6
550.00	.193	−23.5	22.092	73.7	−52.702	68.7	.090	−98.0
600.00	.195	−23.5	22.027	64.5	−52.354	98.2	.097	−99.4
650.00	.195	−23.9	21.960	55.0	−53.418	146.8	.106	−100.5
700.00	.185	−26.6	21.893	45.4	−60.145	162.5	.112	−102.5
750.00	.177	−31.5	21.784	36.3	−55.039	71.8	.121	−104.3
800.00	.174	−36.6	21.720	26.3	−47.281	51.9	.127	−106.2
850.00	.182	−41.2	21.571	15.7	−47.371	49.8	.129	−108.4
900.00	.183	−44.9	21.450	4.9	−56.316	75.2	.132	−113.0
950.00	.189	−49.0	21.291	−5.6	−50.851	112.3	.140	−115.5
1000.00	.194	−49.8	21.113	−16.5	−48.514	75.1	.141	−114.5
1050.00	.195	−47.2	20.897	−26.6	−49.027	80.0	.137	−115.7
1100.00	.192	−44.9	20.699	−36.6	−47.141	74.4	.132	−119.4
1150.00	.193	−43.9	20.454	−46.6	−47.842	81.1	.137	−118.8
1200.00	.197	−45.2	20.181	−56.5	−54.577	110.8	.136	−115.1
1250.00	.204	−47.4	19.852	−65.7	−48.801	78.9	.126	−110.9
1300.00	.218	−50.3	19.508	−75.0	−50.134	59.9	.121	−107.2
1350.00	.238	−56.2	19.256	−84.3	−54.313	93.9	.139	−105.3
1400.00	.245	−59.4	19.032	−94.2	−61.674	110.8	.162	−101.8
1450.00	.240	−61.3	18.695	−104.3	−48.073	131.5	.165	−101.0
1500.00	.231	−64.2	18.389	−114.0	−52.090	123.2	.156	−104.0
1550.00	.228	−65.3	17.998	−123.8	−46.604	136.4	.163	−110.3
1600.00	.228	−65.2	17.527	−133.1	−50.210	116.1	.177	−108.5
1650.00	.228	−66.3	17.069	−142.6	−46.314	152.4	.176	−102.7
1700.00	.224	−68.5	16.509	−151.7	−45.587	138.9	.164	−103.3
1750.00	.224	−70.4	15.967	−160.6	−47.299	140.9	.169	−108.1
1800.00	.223	−72.4	15.427	−169.7	−49.243	164.2	.186	−107.9
1850.00	.225	−73.7	14.855	−179.1	−45.932	159.3	.186	−103.2
1900.00	.226	−73.8	14.335	172.5	−48.546	148.4	.173	−103.5
1950.00	.224	−74.1	13.847	164.0	−44.024	146.4	.173	−108.1
2000.00	.224	−74.5	13.294	156.2	−44.810	154.0	.188	−107.2

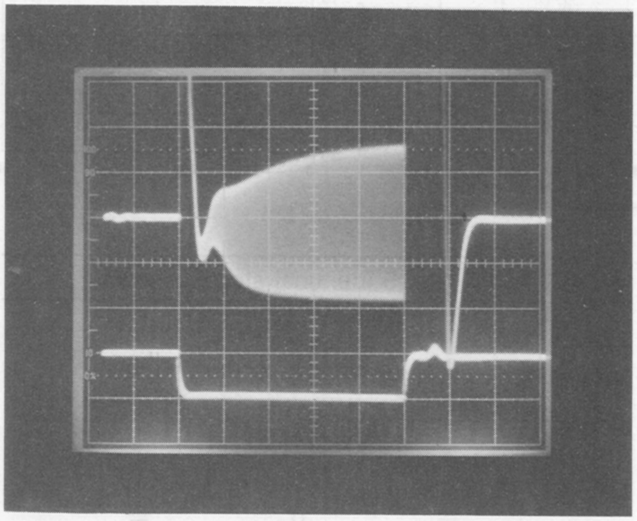
REFERENCE PLANES: 8.50 8.70 17.20



Frequency = 100 MHz
50 μSec./Div.
10 dB Gain Change



Frequency = 100 MHz
50 μSec./Div.
Full AGC Voltage



Frequency = 100 MHz
5 μSec./Div.
Full AGC Voltage

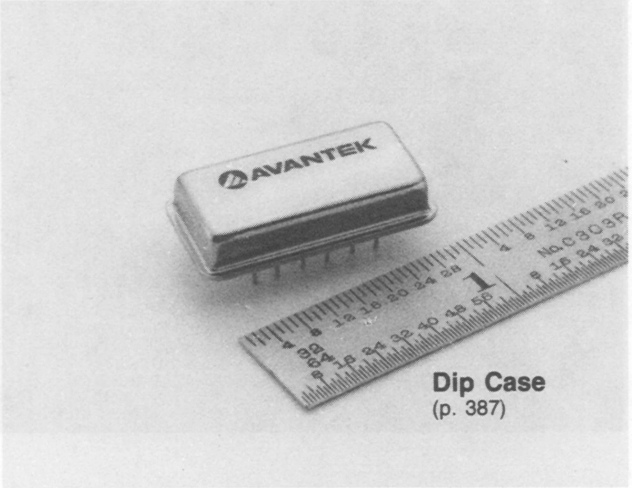
UDL-502

Thin Film
Limiting Amplifier
5-500 MHz

AVANTEK

FEATURES

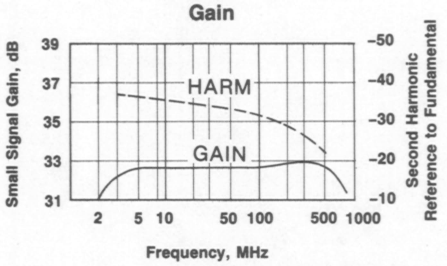
- ±0.5 dB Output Power Flatness Over 30 dB Input Power Range
- Pulse Recovery <2 nsec
- Low Phase Shift Variation
- High Even Harmonic Suppression

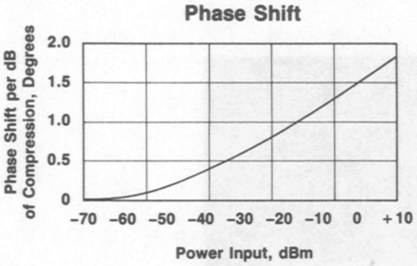

Dip Case
(p. 387)

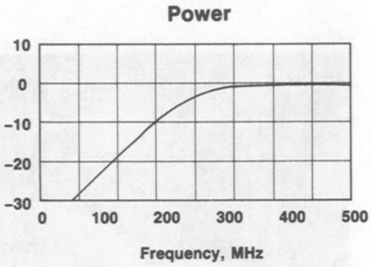
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC and –15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	Unit
BW	Frequency Range	5–500	5–500	5–500	MHz
GP	Small Signal Gain	32.0	30.0 Min.	—	db
—	Saturated Output Power	–2.0	–4.0 Min.	—	dBm
—	Saturated Flatness	—	±0.5	—	db
—	VSWR Input/Output	—	2.0:1 Max.	—	—
—	Even Harmonic Suppression @ $P_{IN} = -50$ to $+7$ dBm	—	15.0	—	dBc
NF	Noise Figure	—	11.0 Max.	—	dB
I_D	Bias Current				
	+15 VDC	60	—	—	mA
	–15 VDC	60	—	—	mA

TYPICAL PERFORMANCE AT 25°C TEMPERATURE


Gain

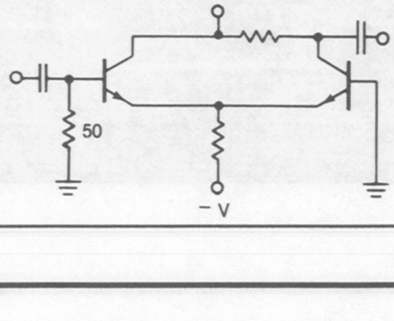

Phase Shift


Power

MAXIMUM RATINGS

DC Voltage .... ±17 Volts
Continuous RF Input Power .... +15 dBm
Operating Case Temperature .... –54°C to +85°C
Storage Temperature .... –62°C to +150°C
"R" Series Burn-In Temperature .... +85°C

SCHEMATIC (1 of 3 identical stages shown)



WEIGHT: (typical) 5.7 grams

NOTES:

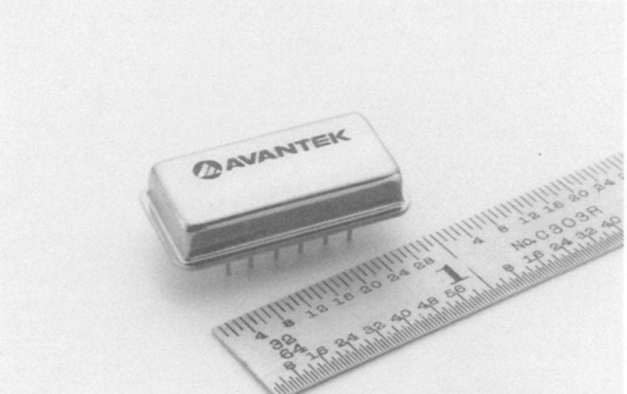
UDL-503
(PRELIMINARY)

Thin Film Limiting Amplifier 5-500 MHz

AVANTEK

FEATURES

- ±0.5 dB Output Power Flatness Over 40 dB Input Power Range
- Low Phase Shift
- High Even Harmonic Suppression



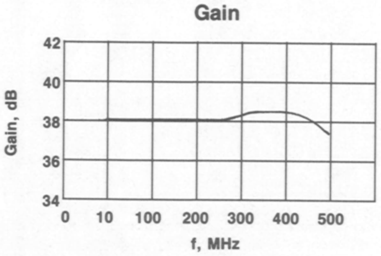
Dip Case
(p. 387)

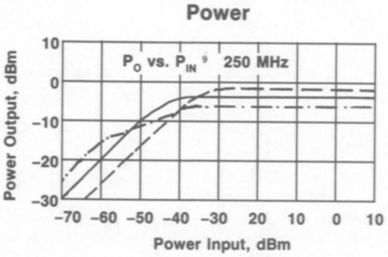
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system at +15 VDC nominal)

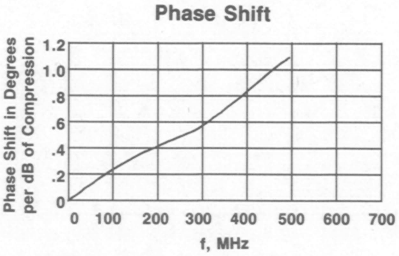
Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		$T_C = 25°C$	$T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	
BW	Frequency Range	5–500	5–500	5–500	MHz
GP	Small Signal Gain	38.0	30.0 Min.	30.0 Min.	db
—	Saturated Output Power @P_{IN} = 0 dbm	−0.5	−2.0 Min.	−4.0 Min.	dBm
—	Saturated Flatness @ P_{IN} = 0 dBm	±0.8	±1.0 Max.	±1.7 Max.	db
—	VSWR Input	1.5:1	2.0:1 Max.	2.0:1 Max.	—
—	VSWR Output	1.2:1	2.0:1 Max.	2.0:1 Max.	—
—	Phase Shift per dB of Compression per MHz	0.0023	—	—	degree
—	Even Harmonic Suppression, @P_{IN} = −33 to +10 dBm	20	15	15	dBc
NF	Noise Figure	9.0	10.0 Max.	11.0	dB
I_D	DC Current	70	—	—	mA

TYPICAL PERFORMANCE AT 25°C TEMPERATURE (unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—







MAXIMUM

DC Voltage	+17 Volts
Continuous RF Input Power	+13.0 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +150°C
"R" Series Burn-In Temperature	+125°C

THERMAL CHARACTERISTICS

θ_{JC}	240°C/W
Active Transistor Power Dissipation	100 mW
Junction Temperature Above Case Temperature	24°C

WEIGHT: (typical) 5.7 grams

NOTES:

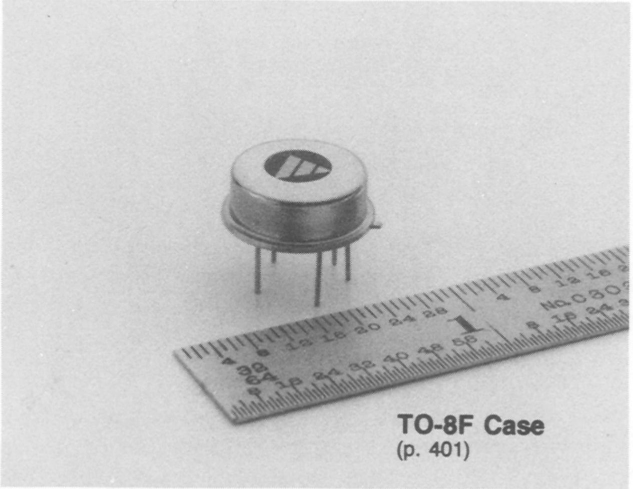
UTL-502

Thin Film
Limiting Amplifier
5-500 MHz

AVANTEK

FEATURES

- **±0.5 dB Output Power Flatness Over 10 dB of Input Power**
- **Pulse Recovery <2 nsec**
- **Low Phase Shift Variation**
- **High Even Harmonic Suppression**



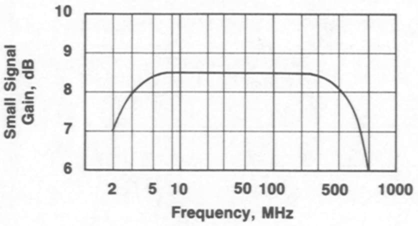
TO-8F Case
(p. 401)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system at +15 VDC and −15 VDC nominal)

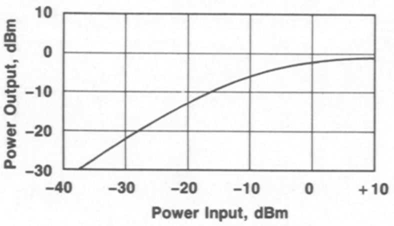
Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	Unit
BW	Frequency Range	5–500	5–500	5–500	MHz
GP	Small Signal Gain	8.5	7.0 min.	—	dB
—	Saturated Output Power	−2.0	−4.0	—	dBm
—	Saturated Flatness	—	±0.5 max.	—	dB
—	VSWR Input/Output	—	2.0:1	—	—
—	Even Harmonic Suppression, @$P_{IN} = -50$ to $+7$ dBm	—	15.0	—	dBc
NF	Noise Figure	—	11.0 max.	—	dB
I_D	Bias Current:				
	+15 VDC	20	—	—	mA
	−15 VDC	20	—	—	mA

TYPICAL PERFORMANCE AT 25°C TEMPERATURE

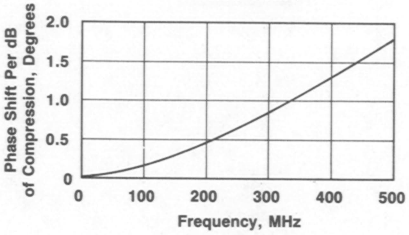
Gain



Power



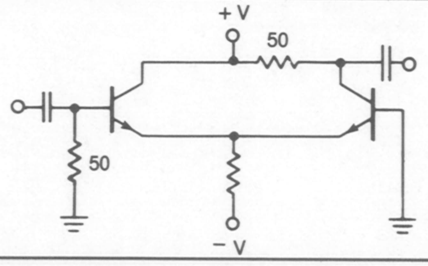
Phase Shift



MAXIMUM RATINGS

DC Voltage .... ±17 Volts
Continuous RF Input Power .... +15.0 dBm
Operating Case Temperature .... −54°C to +85°C
Storage Temperature .... −62°C to +100°C
"R" Series Burn-In Temperature .... +85°C

SCHEMATIC



WEIGHT: (typical) 2.1 grams

NOTES:

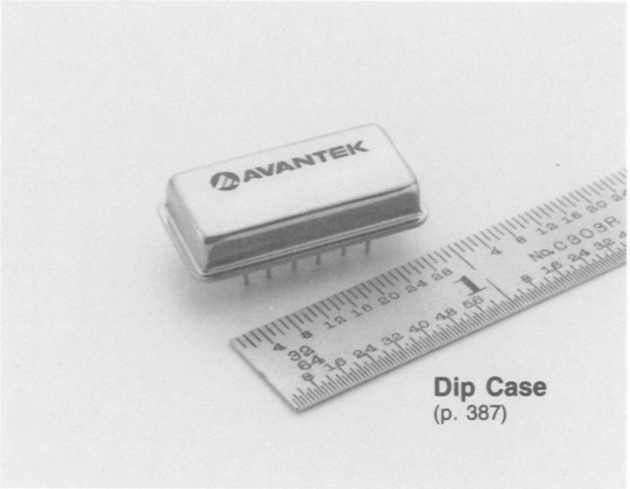
UTL-503
(PRELIMINARY)

Thin Film Limiting Amplifier 5-500 MHz

AVANTEK

FEATURES

- ±0.5 dB Output Power Flatness Over 13 dB Input Power Range
- Low Phase Shift
- High Even Harmonic Suppression

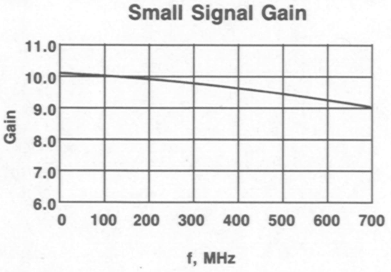


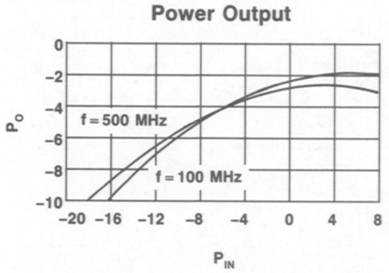
Dip Case
(p. 387)

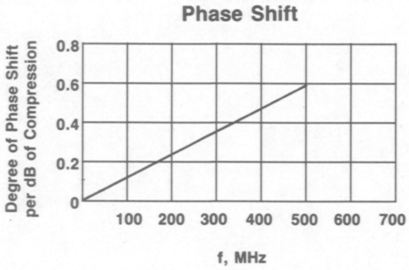
ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system @ +15 VDC nominal)

Symbol	Characteristic	Typical $T_C = 25°C$	Guaranteed Specifications $T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	Unit
BW	Frequency Range	5–500	5–500	5–500	MHz
GP	Small Signal Gain	9.5	8.0 Min.	7.0 Min.	db
—	Saturated Output Power @P_{IN} = 0 dbm	−2.0	−4.0 Min.	−4.0 Min.	dBm
—	Saturated Flatness @ P_{IN} = 0 dBm	±0.3	±1.0 Max.	±1.0 Max.	db
—	VSWR Input	1.3:1	1.5:1 Max.	1.5:1 Max.	—
—	VSWR Output	1.2:1	1.5:1 Max.	1.5:1 Max.	—
—	Even Harmonic Suppression @ P_{IN} = 7 dBm	30.0	20.0 Min.	20.0 Min.	dBc
NF	Noise Figure	8.6	10.0 Max.	10.5 Max.	dB
I_D	Bias Current @ +15 VDC	20	—	—	mA

TYPICAL PERFORMANCE AT 25°C TEMPERATURE


Small Signal Gain


Power Output


Phase Shift

MAXIMUM RATINGS

DC Voltage .... +17 Volts
Continuous RF Input Power .... +15 dBm
Operating Case Temperature .... −55°C to +85°C
Storage Temperature .... −62°C to +150°C
"R" Series Burn-In Temperature .... +125°C

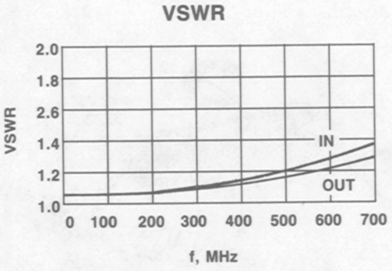
THERMAL CHARACTERISTICS*

θ_{JC} .... 240°C/W
Active Transistor Power Dissipation .... 100 mW
Junction Temperature Above Case Temperature .... 24°C

*For further information, see High Reliability section.

WEIGHT: (typical) 2.1 grams

TYPICAL PERFORMANCE AT 25°C TEMPERATURE (continued)



NOTES:

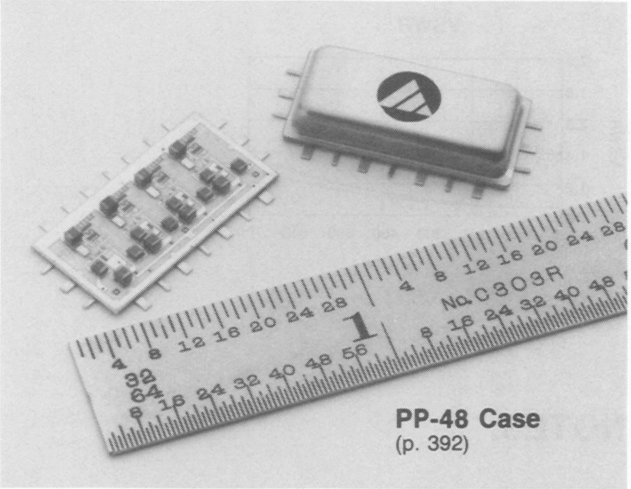
PPL-504

Surface Mount
Limiting Amplifier
10-1000 MHz

AVANTEK

FEATURES

- **Up to 55 dB Compression Range**
- **Low Phase Shift**
- **Wideband Frequency Response**
- **PlanarPak™ Surface Mount Package**



PP-48 Case
(p. 392)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system at +15 VDC nominal)

Symbol	Characteristic	Typical	Guaranteed Specifications		Unit
		$T_C = 25°C$	$T_C = 0°$ to $50°C$	$T_C = -55°$ to $+85°C$	
BW	Frequency Range	10–1000	10–1000	10–1000	MHz
—	Compression Range @ $P_{OUT} = \pm 0.5$ dB				
	10–250 MHz	−52 to +10	−45 to +10	−45 to +10	dBm
	250–500 MHz	−48 to +10	−40 to +10	−40 to +10	
	500–1000 MHz	−32 to +10	−25 to +10	−25 to +10	
—	Saturated Power @ $P_{IN} = 0$ dBm				
	10–1000 MHz	0	−4 Min.	−4 Min.	dBm
—	Saturated Flatness @ $P_{IN} = 0$ dBm				
	10–500 MHz	±0.2	±0.4 Max.	±0.5 Max.	dB
	10–1000 MHz	±0.6	±0.8 Max.	±1.0 Max.	
—	VSWR Input/Output				
	10–500 MHz	1.3/1.3	1.5/1.5 Max.	2.0/2.0 Max.	—
	500–1000 MHz	1.6/2.0	2.0/2.2 Max.	2.0/2.5 Max.	
—	Output Noise Power, 1 MHz BW				
	10–250 MHz	−43	−41 Max.	−38 Max.	dBm
	250–500 MHz	−48	−44 Max.	−42 Max.	
	500–1000 MHz	−57	−46 Max.	−48 Max.	
—	Phase Shift per dB of Compression per MHz, deg				
	10–1000 MHz	0.0035	—	—	
—	Even Harmonic Suppression, @$P_{IN} = 0$ dBm				
	250 MHz	−26	−20 Min.	−20 Min.	dBc
	500 MHz	−18	−13 Min.	−13 Min.	
	1000 MHz	−10	−7	−6	
—	Odd Harmonic Suppression, @$P_{IN} = 0$ dBm				
	250 MHz	−10	−8 Min.	−7 Min.	dBc
	500 MHz	−12	−10 Min.	−8 Min.	
NF	Noise Figure				
	250 MHz	8	—	—	dB
	500 MHz	9	—	—	
	1000 MHz	10	—	—	
I_D	DC Current (@Rated Voltage)	+80	—	—	mA

MAXIMUM RATINGS

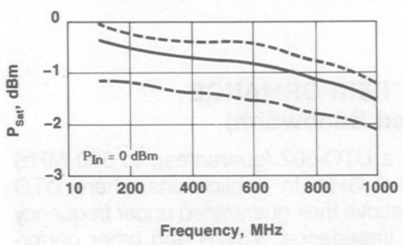
DC Voltage	+17 Volts
Continuous RF Input Power	+15.0 dBm
Operating Case Temperature	−55°C to +125°C
Storage Temperature	−62°C to +125°C
"R" Series Burn-In Temperature	125°C
Temperature Rise (Junction Above Case)	20°C
Thermal Resistance (Junction-Case)	225°C/W
Transistor Power Dissipation	90 mW

WEIGHT: (typical) 1.1 grams

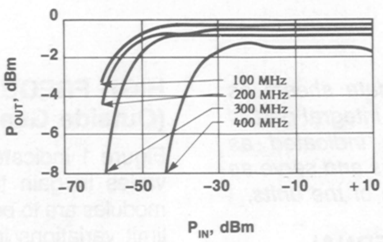
TYPICAL PERFORMANCE OVER TEMPERATURE (@ 15 VDC unless otherwise noted)

KEY:
+25°C ————
+85°C — — — —
−55°C —·—·—

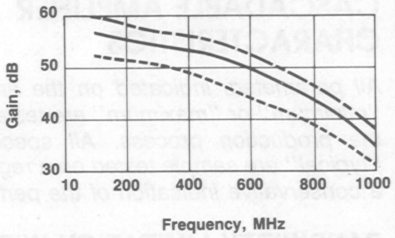
Saturated Power Output



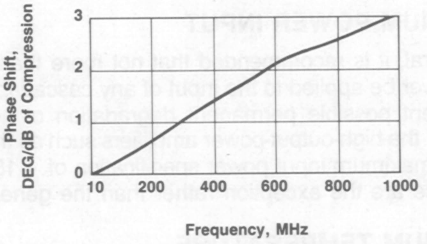
Output Power vs. Input Power



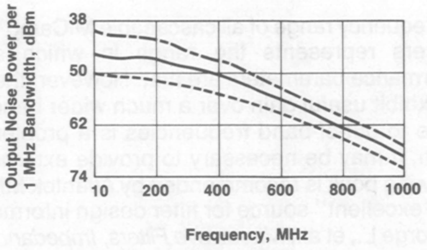
Small Signal Gain



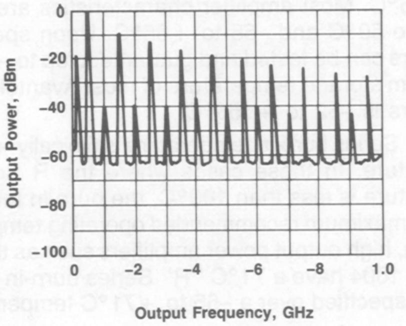
Phase Shift



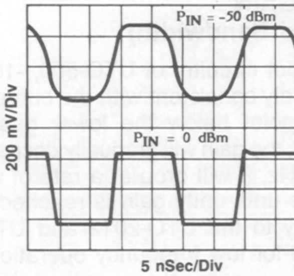
Output Noise Power



Output Spectrum
$f_{IN} = 50$ MHz, $P_{IN} = 0$ dBm



Output Waveform f = 50 MHz



AMPLIFIERS ◦

Application Notes

CASCADABLE AMPLIFIER CHARACTERISTICS

All parameters indicated on the amplifier data sheets as "minimum" or "maximum" are tested as an integral part of the production process. All specifications indicated as "typical" are sample tested on a regular basis and serve as a conservative indication of the performance of the units.

BANDWIDTH LIMITATION WITH EXTERNAL FILTERING

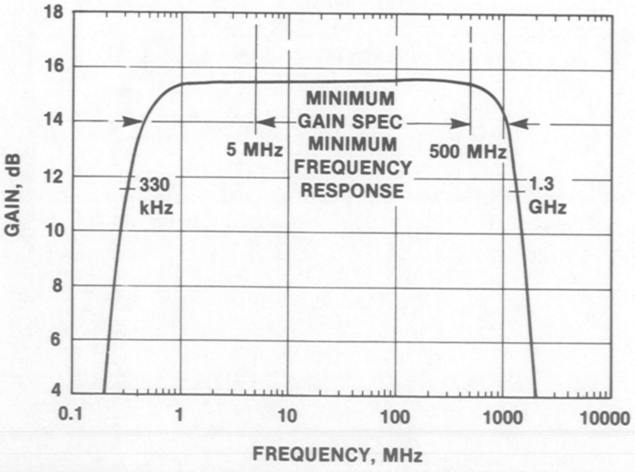
The guaranteed frequency range of all cascadable MICamp® thin film amplifiers represents the range in which all guaranteed performance parameters are met. However, they will continue to exhibit useful gain over a much wider bandwidth. If response to out-of-band frequencies is a problem in a circuit design, it may be necessary to provide external filtering. The following book is recommended by Avantek MIC engineers as an "excellent" source for filter design information: Matthaei, George L., et al., *Microwave Filters, Impedance Matching Networks, and Coupling Structures*, New York, McGraw-Hill Book Company, Inc., 1964.

LOW FREQUENCY GAIN (Outside Guaranteed Bandwidth)

The behavior of the input circuitry of UTO-500, -1000 and -1500 modules is relatively consistent with the curve plotted in figure 1. At some point below the lower guaranteed frequency response limit, the gain will gradually decrease until at approximately 300 kHz, it will drop at a rate of approximately 6 dB per octave until unity gain is reached. These comments do not apply to the UTO-2012 and UTO-2013 which are not designed for low frequency operation.

Designing circuits around UTO modules at low frequencies must be done on a case-by-case basis since changes in input impedance, VSWR and other parameters will appear when the units are operated outside the normal guaranteed bandwidth. Avantek applications engineers can provide answers to specific applications questions.

Figure 1. Typical Gain Response of UTO-502 (Between Unity Gain Points)



HIGH FREQUENCY PERFORMANCE (Outside Guaranteed Bandwdith)

Figure 1 indicates how a UTO-502 (guaranteed to 500 MHz) varies in gain through 2 GHz. In applications where UTO modules are to be used above their guaranteed upper frequency limit variations in input impedance, VSWR and other performance parameters will have to be taken into consideration.

MAXIMUM POWER INPUT

In general, it is recommended that not more than +13 dBm CW power be applied to the input of any cascadable amplifier to prevent possible permanent degradation of noise figure. Some of the high-output-power amplifiers such as the UTO-561 have a maximum input power specification of +18 dBm CW, but these are the exception rather than the general rule.

MAXIMUM TEMPERATURE

The maximum operating temperature over which Avantek will guarantee performance for most cascadable amplifiers is –55 to +105°C. Most amplifier characteristics are guaranteed over 0 to 50°C and –55 to +85°C. Upon special request amplifiers can be tested and guaranteed up to +105°C. The maximum storage temperature of most Avantek cascadable amplifiers is –62 to +150°C.

The "R" Series burn-in temperature is typically +125°C case temperature. In those cases where the R Series burn-in temperature is less than 100°C, the burn-in temperature is also the maximum recommended operating temperature. For example, high output power amplifiers such as the UTO-546, 561 and 1004 have a 71°C "R" Series burn-in temperature and are specified over a –55 to +71°C temperature range.

POWER DISSIPATION AND THERMAL CONSIDERATIONS

Avantek amplifier modules will dissipate as little as 55 mW for the GPD-252 to as much as 2.85W for the UTO-561 when operating under normal conditions and voltages. Avantek engineers have found that in virtually all cases mounting one or more modules on a standard microstrip circuit board (with proper grounding to the ground plane side of the board) will provide enough heat dissipation to prevent excessive temperature rise or performance degradation.

For special applications requiring a more thorough investigation of heat dissipation, information is available from the factory on internal and external thermal characteristics of all Avantek thin-film modular products.

MINIMUM USABLE SIGNAL INPUT POWER — AMPLIFIER SENSITIVITY[1]

The lowest input signal power level which will produce a detectable output from an amplifier stage is determined by the thermal noise generated within the amplifier itself. Any signal below the "noise floor" will not produce any apparent change in amplifier output, since the signal to noise ratio becomes unity.

Note 1: For more detailed information see Design Feature article "Where Lies The Thermal Noise Floor?" at the end of this section published in Microwave & RF, July, 1984.

The following equation can be used to determine the thermal "noise floor" and thus, the minimum signal level that can be amplified by a cascadable amplifier stage.

$$P_N = -114\ \text{dBm} + 10 \log B + 10 \log (10^{NF/10} - 1)$$

Where P_N = effective input noise power, or minimum amplifiable signal level. B = Bandwidth of amplifier system (in MHz). It is the 3 dB bandwidth of the amplifier, or of any filter that is used ahead of the amplifier to limit overall bandwidth.

Referring to figure 1, the 3 dB bandwidth of a UTO-502 is approximately 1.3 GHz, and its guaranteed maximum noise figure (0-50°C) is 4.0 dB.

So, for its full bandwidth,

$$P_N = -114 + 10 \log (1.3 \times 10^3) + 10 \log (10^{\cdot 4} - 1) = -81.1\ \text{dBm}$$

or if the bandwidth is limited to 1 MHz,

$$P_N = -114 + 10 \log (1) + 10 \log (10^{\cdot 4} - 1) = -112.2\ \text{dBm}$$

In many applications, the actual noise floor of the UTO amplifier is increased due to effective thermal noise produced by the input circuitry, transmission lines, etc. For example, if the input circuitry ahead of the UTO-502 introduces 3.5 dB of loss, the loss would add directly to the noise figure, therefore the effective noise figure of the stage would be 5.3 dB.

Note: For communications engineers working with noise temperature rather than noise figure, the effective noise temperature (Te) of a UTO amplifier in °K can be found from:

$$Te = 290[(\log_{10}^{-1} NF) - 1]$$

INTERCEPT POINT

The concept of Intercept Point as an indicator of the spurious-free dynamic range of an amplifier was first introduced by an Avantek engineer in 1967. A copy of the original article appearing in the February 1, 1967 issue of *Electronic Design* along with an enlarged version of the Intercept Point nomograph is available from the Avantek factory or from local representatives.

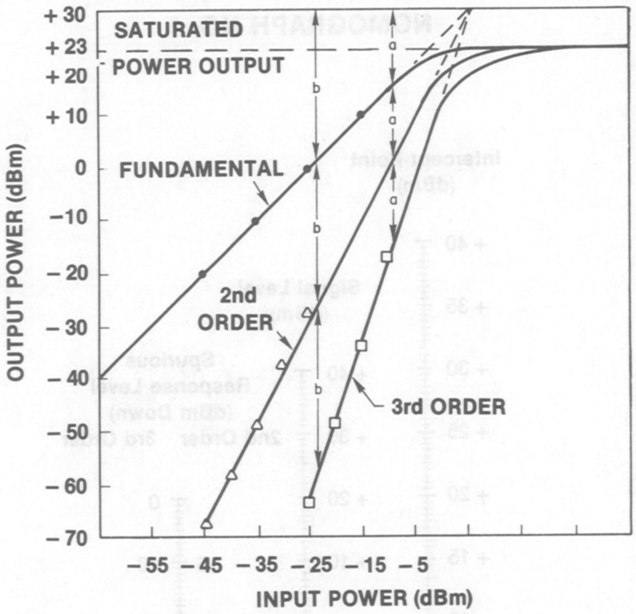
If the fundamental input power vs. output power response of an amplifier is plotted on a log-log scale, it will have a 1:1 slope (see fig. 2) in the linear operating region. It has been determined that a plot of the second-order intermodulation products of the amplifier, plotted on the same scale will have a slope of 2:1, and the third order products a slope of 3:1.

Since the third-order spurious products are the most troublesome, falling within the bandpass of even moderate bandwidth amplifiers, the intercept point is generally defined as the point where extensions of the first and third order responses intersect on the output power scale. Note that the second-order response plot will generally intersect at the same point as well, unless the amplifier design suppresses even-order responses (for example, push-pull stages).

The plot of amplifier responses is a set of straight lines on the log-log scale. The slope of the line depends on the order; the fundamental has a slope of 1, the second order has a slope of 2 and the third order has a slope of 3. The intersection of the fundamental and third order yields the intercept point.

When the amplifier is operating in the linear amplification range (i.e., below the 1 dB gain compression point), the levels of the spurious responses can be estimated accurately with a simple calculation or by using the nomograph.

Figure 2. Input Intercept Point Graph



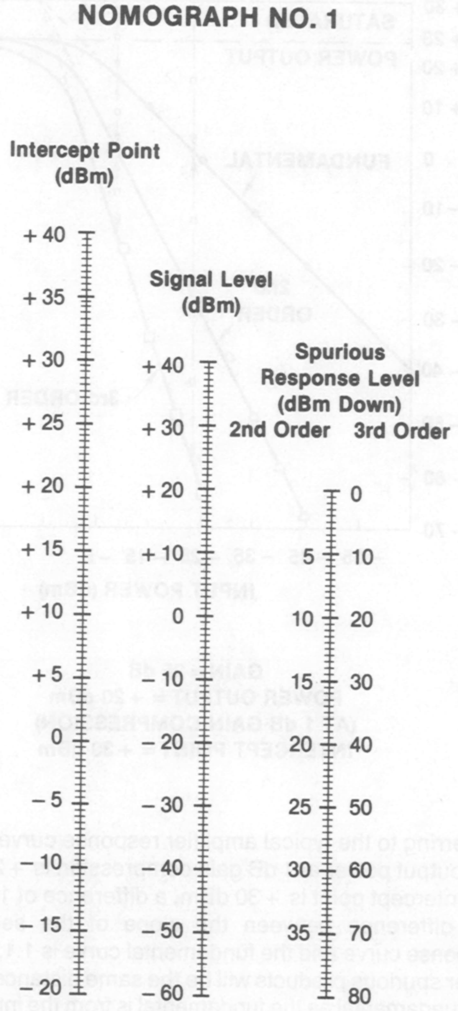
GAIN = 25 dB
POWER OUTPUT = +20 dBm
(AT 1 dB GAIN COMPRESSION)
INTERCEPT POINT = +30 dBm

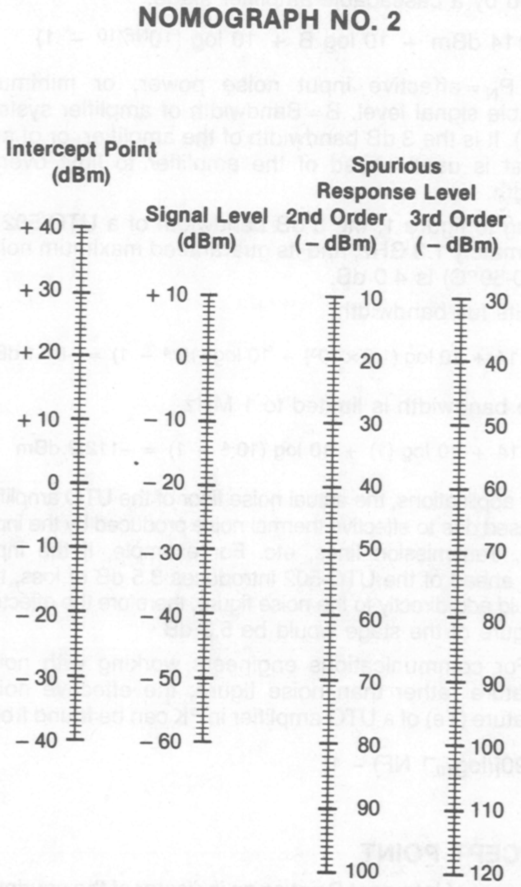
Referring to the typical amplifier response curve of figure 2, the output power at 1 dB gain compression is +20 dBm and the intercept point is +30 dBm, a difference of 10 dB. Since the difference between the slope of the second order response curve and the fundamental curve is 1:1, the second order spurious products will be the same distance down from the fundamental as the fundamental is from the intercept point at any output power. Similarly, since the difference between the slope of the third order curve and the fundamental is 2:1, the third order products will be twice the distance down from the fundamental as the fundamental is from the intercept point at any output power in the linear range. For example, if the amplifier is driven to +15 dBm output power, the second order product will be suppressed to 15 dB below the output signal and the third order product will be an additional 15 dB below the second order product (a to a to a on figure 2). If the amplifier was driven to provide 0 dBm output power, the suppression of the second order product relative to the output signal would be 30 dB and the third order product would be an additional 30 dB or 60 dB below the desired output (b to b to b on figure 2).

AUTOMATIC NETWORK ANALYZER CHARACTERIZATIONS OF CASCADABLE AMPLIFIERS

The data sheet for each amplifier has a printout from the Hewlett-Packard 8542A automatic network analyzer. The measurements were made on random samples taken from current production runs and can be considered, within normal production variations, as typical of the characteristics of units currently being shipped.

Figure 3. Dynamic Range Nomographs


NOMOGRAPH NO. 1
Intercept Point (dBm)
+40
+35
+30
+25
+20
+15
+10
+5
0
−5
−10
−15
−20
Signal Level (dBm)
+40
+30
+20
+10
0
−10
−20
−30
−40
−50
−60
Spurious Response Level (dBm Down)
2nd Order
3rd Order
5
10
15
20
25
30
35
0
10
20
30
40
50
60
70
80


NOMOGRAPH NO. 2
Intercept Point (dBm)
+40
+30
+20
+10
0
−10
−20
−30
−40
Signal Level (dBm)
+10
0
−10
−20
−30
−40
−50
−60
Spurious Response Level
2nd Order (−dBm)
3rd Order (−dBm)
10
20
30
40
50
60
70
80
90
100
30
40
50
60
70
80
90
100
110
120

EXAMPLE 1

Given Intercept Point +30 dBm
Output Signal Level −10 dBm

Find Third Order IM Level

Line up ruler on +30 on Intercept Point Scale and −10 dBm on Signal Level Scale. Read −90 dBm on Nomograph 2 or 80 dB down on Nomograph 1. The spurious responses are at −90 dBm, or 80 dB down from the signals at −10 dBm.

The Intercept Point is given for the output level. When input levels are being considered, the amplifier gain must be taken into consideration.

EXAMPLE 2

Given Intercept Point +30 dBm
Input Signal −30 dBm
Amplifier Gain 30 dB

Find Third Order Spurious Level at the Output

At the output, the two signals will be at 0 dBm (−30 dBm +30 dBm).

Line up ruler on +30 dBm on the Intercept Point Scale and 0 dBm on the Signal Level Scale. Read −60 dBm on Nomograph 2 or 60 dB down on Nomograph 1.

Unequal signals must be converted to equivalent equal signals by subtracting from the stranger signal one third of the difference between the two signals measured in dB.

EXAMPLE 3

Given Intercept Point +30 dBm
Output Signals at −3 dBm and at −18 dBm

Find Third Order Spurious Response

Step 1. Find equivalent equal signal level

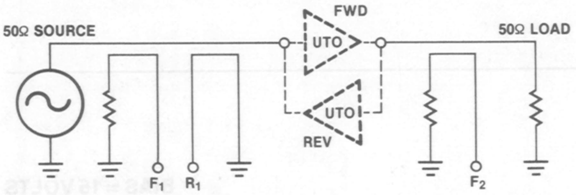
The difference between two signals at −3 dBm and −18 dBm is 15 dB. One third of 15 dB is 5 dB. Subtract 5 dB from −3 dBm. The resultant signal level, −8 dBm is the equivalent equal signal level.

Line up ruler with +30 dBm on the Intercept Point Scale, −8 dBm on the Signal Level Scale and read 76 dB down on Nomograph 1, or −84 dBm on Nomograph 2.

S-Parameter Printouts

The action of the automatic network analyzer in measuring the S parameters of a cascadable amplifier can be explained by the extremely simplified schematic shown. Two directional couplers are placed at the input and one at the output of the cascadable amplifier, and the power levels and phase angles are measured at each of the terminals.

Figure 4. S-Parameter Measurements.



If the amplifier is placed in the circuit in the forward direction:

$$S_{11} = \frac{|R_1|}{|F_1|} \angle \phi R_1 - \phi F_1$$

$$S_{21} = \frac{|F_2|}{|F_1|} \angle \phi F_2 - \phi F_1$$

S_{11} = input reflection coefficient, expressed at a ratio and angle —

$\therefore \varrho$ forward (dB) = 10 log $|S_{11}|^2$

$|S_{21}|^2$ = forward insertion gain

$\therefore$ gain (dB) = 10 log $S_{21}{}^2$, and $\angle S_{21}$ = insertion phase shift Φ

By reversing the UTO in the set-up —

$$S_{12} = \frac{|F_2|}{|F_1|} \angle \phi F_2 - \phi F_1$$

and

$$S_{22} = \frac{|R_2|}{|F_1|} \angle \phi R_2 - \phi F_1$$

and S_{22} = output reflection coefficient, expressed as a ratio and angle.

$\therefore \varrho$rev (dB) = 10 log $|S_{22}|^2$

$|S_{12}|^2$ = reverse insertion gain

$\therefore$ reverse isolation (dB) = 10 log $|S_{12}|^2$

An example of the typical numerical readings data provided for each amplifier is shown below.

AUTOMATIC NETWORK ANALYZER MEASUREMENTS (Typical production unit at + 25°C ambient)

NUMERICAL READINGS

BIAS = 15.00 VOLTS

FREQ MHz	VSWR IN	GAIN dB	PHASE DEG	PHASE DEV	PHASE DEV	GROUP DELAY nS	VSWR OUT	ISOL dB
100.0	1.06	14.88	159.07	– 1.71	– .72	—	1.06	20.91
150.0	1.11	14.78	149.98	– .35	.35	.53	1.10	20.51
200.0	1.13	14.74	140.11	.21	.65	.59	1.12	21.06
250.0	1.14	14.74	128.87	– .58	– .40	.58	1.15	20.82
300.0	1.17	14.81	119.31	.30	.21	.54	1.16	20.69
350.0	1.18	14.67	109.49	.90	.55	.59	1.21	21.10
400.0	1.19	14.68	98.24	.10	– .51	.58	1.25	20.98
450.0	1.19	14.79	88.51	.81	– .07	.55	1.25	20.81
500.0	1.19	14.76	78.37	1.11	– .04	.57	1.29	20.89
550.0	1.19	14.81	68.04	1.23	—	.59	1.35	20.52
600.0	1.18	14.83	57.17	.79	—	.60	1.38	20.58
650.0	1.23	14.74	46.35	.41	—	.63	1.40	21.01
700.0	1.29	14.85	34.54	– .94	—	.61	1.41	20.86
750.0	1.41	14.89	24.51	– .54	—	.60	1.45	20.78
800.0	1.56	14.77	12.88	– 1.73	—	.67	1.45	21.09
850.0	1.77	14.71	.23	—	—	.68	1.43	21.20
900.0	2.02	14.62	– 11.75	—	—	.69	1.39	21.26
950.0	2.41	14.32	– 24.58	—	—	.72	1.38	21.47
1000.0	2.82	14.15	– 37.67	—	—	.70	1.33	22.11
1050.0	3.34	13.77	– 49.83	—	—	.64	1.29	21.94
1100.0	4.20	13.26	– 60.89	—	—	.66	1.27	22.13
1150.0	5.33	12.88	– 73.51	—	—	.70	1.27	23.24
1200.0	6.49	12.10	– 86.00	—	—	.68	1.29	23.94
LINEARIZATION RANGE				100.0 TO 800.0	100.0 TO 500.0			

At 300 MHz the UTO-502 S parameters were

S_{11} = input reflection coefficient
$= .073 \quad \angle 63.1$

S_{21} = forward insertion gain
$= 5.365 \quad \angle 119.8$

S_{12} = reverse isolation gain
$= .094 \quad \angle -19.8$

S_{22} = output reflection coefficient
$= .062 \quad \angle 178.5$

Other-Parameter Printouts

The second printout for each amplifier type indicates the gain, phase angle, deviation from the computed linear phase vs. frequency curve, gain flatness, group delay, VSWR and reverse isolation for the specific sample.

Shown below is the typical S parameter data for the UTO-502 amplifier.

S-PARAMETERS, MAGNITUDES AND ANGLES

BIAS = 15 VOLTS

FREQ MHz	11 RATIO	11 ANGLE	21 RATIO	21 ANGLE	12 RATIO	12 ANGLE	22 RATIO	22 ANGLE
100.00	.030	73.6	5.407	157.7	.094	– 5.4	.025	– 153.0
200.00	.056	69.3	5.338	139.9	.093	– 12.2	.040	– 164.0
300.00	.073	63.1	5.365	119.8	.094	– 19.8	.062	178.5
400.00	.079	59.3	5.306	99.4	.092	– 27.0	.086	161.3
500.00	.074	62.4	5.363	80.1	.094	– 35.8	.116	143.5
600.00	.066	84.8	5.417	59.7	.092	– 43.4	.139	126.3
700.00	.093	115.5	5.512	38.1	.094	– 51.7	.164	106.3
800.00	.173	125.4	5.454	16.9	.091	– 61.9	.177	86.0
900.00	.293	120.1	5.473	– 8.3	.088	– 74.6	.179	60.4
1000.00	.438	108.3	5.293	– 32.7	.084	– 86.9	.154	31.5

Note that there are two phase deviation columns, measured over different frequency ranges. Differences in phase deviation figures between the two columns results from the fact that the network analyzer calculates the linear phase/frequency curve based only on the points measured within the specified frequency range (refer to Phase Linearity for additional explanation).

For a more complete discussion of both the operation of the H-P automatic network analyzer and the meaning and use of S parameters, a good reference is *S-Parameters...Circuit Analysis and Design, Application Note 95*, which is available from Hewlett-Packard.

GROUP DELAY

If a single frequency signal is applied to the input port of any device, active or passive, its relative phase at the output port will be shifted by an amount related to the time it takes to propagate through the device. This single-frequency phase delay may be expressed by the identity:

$$t_f = \frac{\Delta\phi}{\omega}$$

In an ideal device, phase delay would be directly proportional to frequency and the t_f term would *always* remain constant, regardless of the frequency (or multiple frequencies) of the applied signals.

In actual devices, the propagation velocity (and, therefore, the phase delay) always has a non-linear relationship to the applied frequency. If two frequencies are applied to the input port of an actual device, each will be propagated at a different velocity and the modulation envelope (caused by the beating of the two frequencies) will be propagated at a third—the envelope or *group* velocity.

The group delay of a device is directly related to the rate of change of phase shift vs. frequency, and can be expressed in units of time with the identity:

$$t_d = \frac{d\phi}{d\omega}$$

Group delay may be measured by varying the frequency of the signal in small increments, measuring the corresponding change in phase of the output signal.

$$t_d = \frac{\Delta\phi n}{360°\ fn}$$

Alternatively, if the input waveform consists of an amplitude modulated carrier, the group delay is directly related to the phase shift of the modulation envelope as the carrier is swept through the bandwidth of interest. The group delay measured in this manner can be expressed by:

$$t_d = \frac{\phi e}{fm \times 360°}$$

It will be seen from the automatic network analyzer printouts that the group delays of the production sample amplifiers are less than 1 ns per stage (the UTO-504, -521 and -523 have two stages) and relatively constant over the entire operating bandwidth.

Since there is no appreciable interaction between the group delay of UTO, UTF and UTL devices when they are operated in a conventional 50-ohm microstrip environment, the total group delay of a cascade of these modules will be approximately equal to the sum of their individual group delays (plus the group delay introduced by transmission line sections), t_d cascade $\cong t_{d_1} + ...t_{d_n}$.

In applications where the modules are used in other than 50-ohm circuits, where the impedances they see vary widely with frequency or when the cascade group delay must be determined precisely, the group delay of the complete cascade should be measured using a swept modulated signal source and vector voltmeter set-up or with an automatic network analyzer.

t_f = single frequency phase delay (in seconds)
t_d = group delay (in seconds)
Φ = carrier phase shift (in degrees)
f = carrier frequency (Hz)
ω = carrier frequency (radians/second)
Φe = modulation envelope phase shift (in degrees)
f_m = modulation frequency (Hz)

PHASE LINEARITY

As previously discussed (see *Group Delay*), an ideal active device, such as an amplifier, would exhibit a linear relationship between signal frequency and phase shift. A plot of this "ideal" relationship would result in a straight line curve with slope dependent on the effective electrical length of the device. In practical situations, the curve will not be a perfectly straight line, but will exhibit perturbations of a few degrees to either side of linear.

Phase linearity of a device is usually expressed as the maximum deviation from the linear curve within the band of interest or simply by reference to a listing of the phase deviation at a number of discrete frequencies. Such a listing is presented for most amplifiers, and it will be seen that the phase deviation is never more than a few degrees from linear.

In producing the phase deviation data, the automatic network analyzer first measures the relative phase shift through the amplifier at a number of frequencies specified by the programmer. Next, using the method of least squares, it fits the actual data points to a straight-line curve which becomes the "ideal" curve for the particular amplifier. Finally, it prints out the deviation from this straight line at each of the specified frequencies. This process of fitting accounts for the differences in deviation in the two "PHASE DEV" columns of each ANA printout—in each case the number of points (and the values of some of them) over which the "fit" was made differs.

Figure 5a. UTO-501 Phase Change

The curves below show the typical phase shift of several UTO amplifiers as a function of input power.

Phase Change vs Input Power at 70 MHz

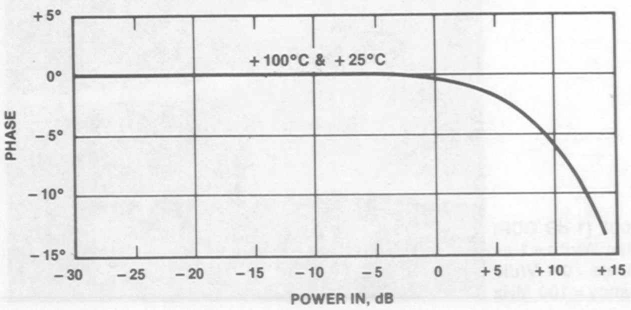
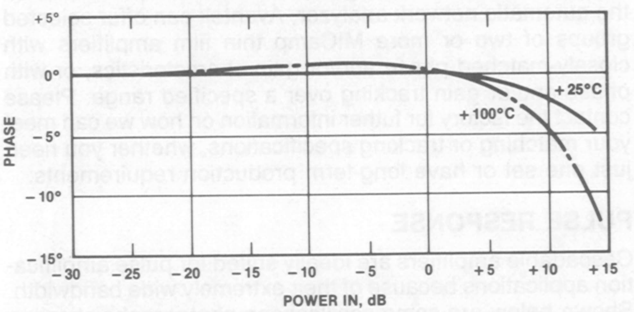


Figure 5b. UTO-511 Phase Change

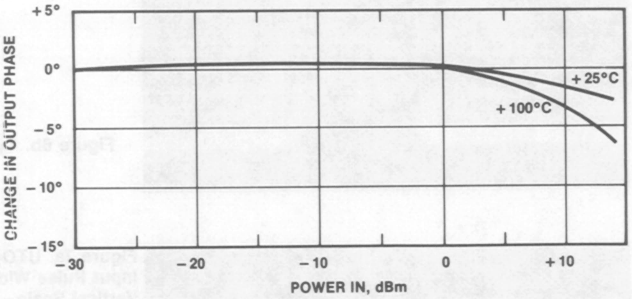
Phase Change vs Input Power at 70 MHz



For both of the above amplifiers the typical output compression point was approximately +0.5 dBm. The gain of the UTO-501 is typically 15.1 dB at 70 MHz, and the gain of the UTO-511 is typically 17.4 dB at 70 MHz. Input compression points would be −14.6 dBm for the UTO-501 and −16.9 dB for the UTO-511. In both cases no phase shift took place until the input level approached 0 dBm.

Figure 5c. UTO-513 Phase Change with dc Bias of +15 Volts

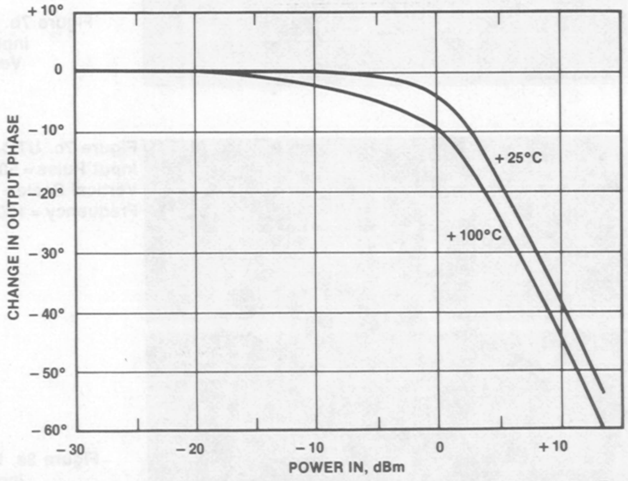
Phase Change vs Input Power at 70 MHz



At 15 volt bias, the output compression level of the UTO-513 is +10 dBm and its gain is 16.5 dB at 70 MHz. Input compression would be -6.5 dBm. Although its phase began to shift with a 0 dBm input power, its phase shift is only -2.5° at +10 dBm (100°C) compared to -5.0° for the UTO-501 and -511.

Figure 5d. UTO-521 Phase Shift

Phase Change vs Input Power at 70 MHz



The UTO-521 has an input compression point of -23.5 dBm and consequently starts to exhibit a phase shift with input powers exceeding −17 dBm.

Phase and Gain Matched UTO Modules

Through the use of a programmed selection procedure on the automatic network analyzer, Avantek can offer selected groups of two or more MICamp thin film amplifiers with closely-matched phase and/or gain characteristics, or with phase and/or gain tracking over a specified range. Please contact the factory for futher information on how we can meet your matching or tracking specifications, whether you need just one set or have long-term production requirements.

PULSE RESPONSE

Cascadable amplifiers are ideally suited for pulse amplification applications because of their extremely wide bandwidth. Shown below are some oscilloscope photographs showing the rise time and fall time of the UTO-1002 and -1521 amplifiers under pulsed conditions. The response is shown for input levels both below and above the 1 dB gain compression level. The bracketed number following the model number indicates how far the input signal has driven the output of the amplifier being characterized relative to the 1 dB gain compression point, i.e., the notation (−10 dB) indicates that the amplifier output is 10 dB below the 1 dB gain compression point. Unless otherwise indicated, the horizontal scale is 20 nsec/division.

The UTO-1002 is a single-stage amplifier with a specified frequency response of 5 to 1000 MHz, a typical gain of 14.5 dB and a typical 1 dB output compression point of +8.5 dBm. The UTO-1521 is a three-stage amplifier with a frequency response of 1 to 1500 MHz and a typical 1 dB output compression point of +16 dBm.

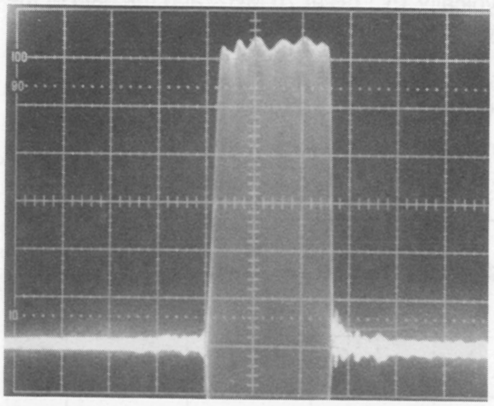


Figure 6a. Typical Input Waveform
Width = 50 ns
Frequency = 100 MHz

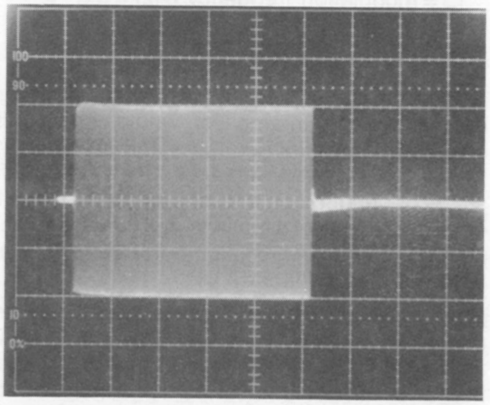


Figure 6b. Typical Input Waveform
Width = 1 μs
Frequency = 100 MHz

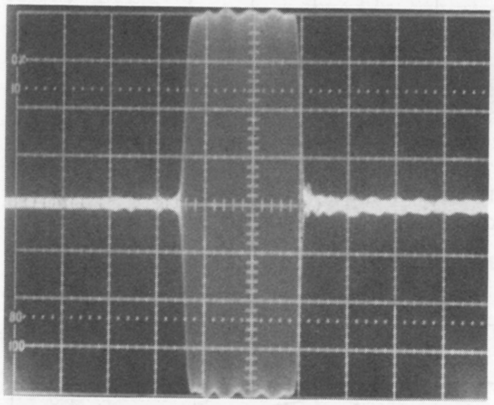


Figure 7a. UTO-1002 (−10 dB)
Input Pulse Width = 50 ns
Vertical Scale = 20 mW/div
Frequency = 100 MHz

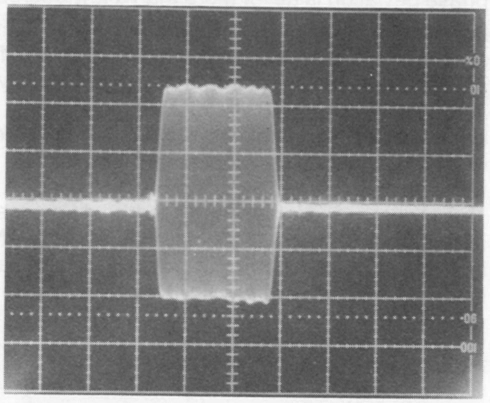


Figure 7b. UTO-1002 (1 dB GCP)
Input Pulse Width = 50 ns
Vertical Scale = 0.1 V/div
Frequency = 100 MHz

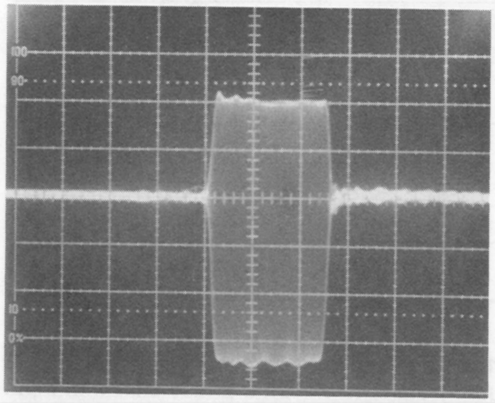


Figure 7c. UTO-1002 (+3 dB)
Input Pulse = 50 ns
Vertical Scale = 0.1 V/div
Frequency = 100 MHz

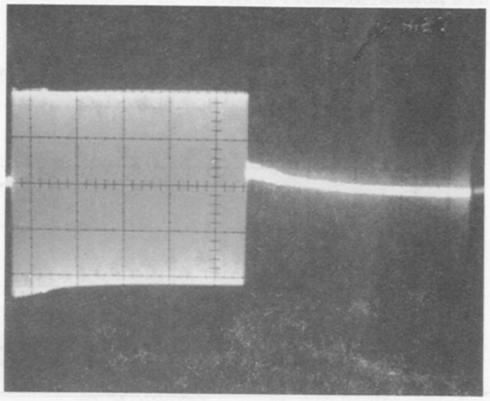


Figure 8a. UTO-1002 (1 dB GCP)
Input Pulse Width = 1 μs
Vertical Scale = 0.1 V/div
Frequency = 100 MHz

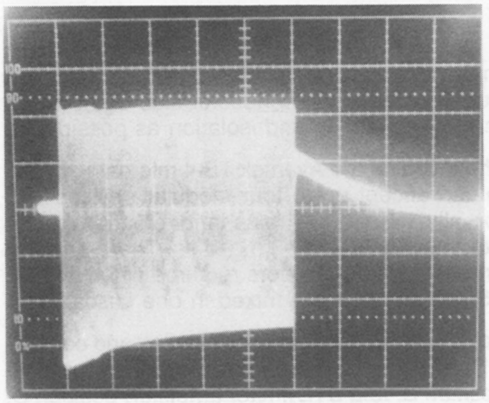
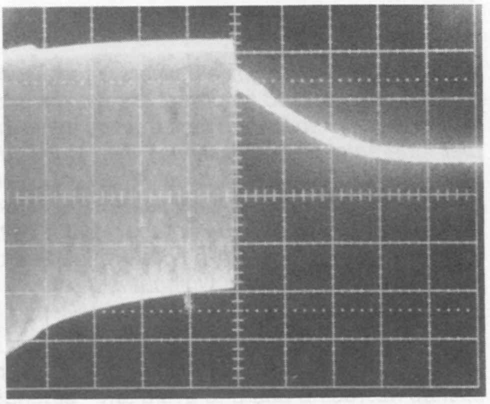


Figure 8b. UTO-1002 (+3 dB)
Input Pulse = 1 μs
Vertical Scale = 0.1 V/div
Frequency = 100 MHz

Figure 8c. UTO-1002 (+5 dB)
Input Pulse = 50 ns
Vertical Scale = 0.1 V/div
Horizontal Scale = 0.2 μs/div
Frequency = 100 MHz



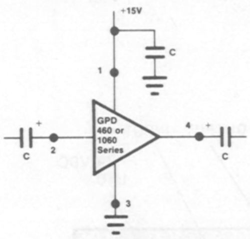
It should be noted that the performance of an amplifier module in pulse operation is stongly influenced by the characteristics of the external circuitry. Any transmission line sections, stray reactances and electrical lengths have their individual effects, as does the particular circuit layout surrounding the amplifier module.

CALCULATING THE LOW FREQUENCY RESPONSE OF A GPD AMPLIFIER

Neither the 460/1060 series GPD amplifiers have internal coupling capacitors. These, along with the dc bias bypass capacitor must be provided in the external circuit. By selecting the values of the capacitors, the low frequency roll-off point may be set as close to DC as required.

Figure 9a. GPD Circuit

EXAMPLE:



eg. 200 Hz LOW END, C = 50 μfd, THREE PLACES.

The design curves of figure 9b and 9c can be used to determine the proper input, output and bias bypass capacitor values. Figure 9b provides the required capacitor value for the desired frequency response. Figure 9c will provide the gain roll-off.

For example, to produce a flat frequency response to 200 Hz, from figure 9b, a capacitive value of 50 μfd should be used.

From figure 9c it can be seen that if 50 μfd capacitors are used the gain of the amplifier will only be reduced by 0.05 dB at 200 Hz. At 100 Hz the roll-off would be 0.2 dB, at 50 Hz the roll-off would be 0.85 dB and at 30 Hz the gain would be reduced by 3 dB.

Figure 9b. Capacitor Values for Amplifier Low Frequency Response

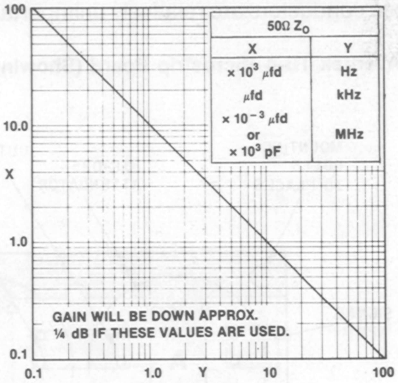
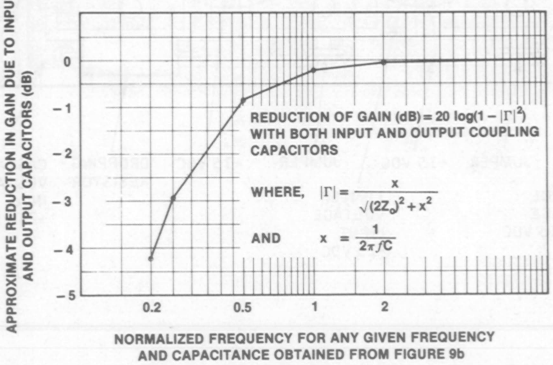


Figure 9c.



REDUCTION OF GAIN (dB) = $20 \log(1 - |\Gamma|^2)$ WITH BOTH INPUT AND OUTPUT COUPLING CAPACITORS

WHERE, $|\Gamma| = \frac{x}{\sqrt{(2Z_o)^2 + x^2}}$

AND $x = \frac{1}{2\pi f C}$

INSTALLATION

All cascadable thin film amplifiers and associated limiters, attenuators and AGC amplifiers are designed to operate with unconditional stability and performance equal to or better than their guaranteed specifications when installed in a properly designed 50-ohm microstripline PC board. Oscillation or other problems encountered with systems using MICamp amplifers can be directly traced to improper layout of the PC board, improper grounding of the devices to the board or the board to the case or chassis in which it is installed, or the lack of RF bypassing on DC leads when required.

In this section basic information on microstrip circuit design will be presented to allow a designer to properly plan his custom microstrip board to avoid any "surprises" when it is turned on.

Microstripline Characteristics

A microstrip transmission line is fabricated with a single narrow conductor on one side of a relatively thin sheet of dielectric medium with a large area of ground plane on the other side. Generally the dielectric sheet is in the form of either a ceramic substrate for thin and thick film hybrid integrated circuits or PC board material for assemblies.

Electrically, a microstripline behaves like a two-wire transmission line with the second conductor formed by the image of the physcial conductor appearing on the ground plane.

The characteristic impedance of a microstripline is determined by the width of the conductor and the dielectric constant and thickness of the substrate material on which it is fabricated. For the 0.062 in. thick, G-10 glass epoxy PC board material (1 oz. clad, both sides) used in the Avantek boards (and widely used elsewhere), a 50-ohm stripline is always 0.10 in. wide.

In a practical application, other conductors also appear on the microstrip board for DC bias and control voltages. The widths of these conductors are relatively unimportant so long as they are narrow compared to the large grounded areas which make up the bulk of the conductor side of the board to provide as much shielding and isolation as possible.

Figure 10 is the layout of the Avantek TB-4 microstrip circuit board, which can accept up to four modular devices with provisions for all RF and DC bias and control voltage connections to any Avantek TO-8 modules. There are also provisions for the dropping resistors required when 24 volt, 15 volt, and 5 volt modules are mixed in one cascade.

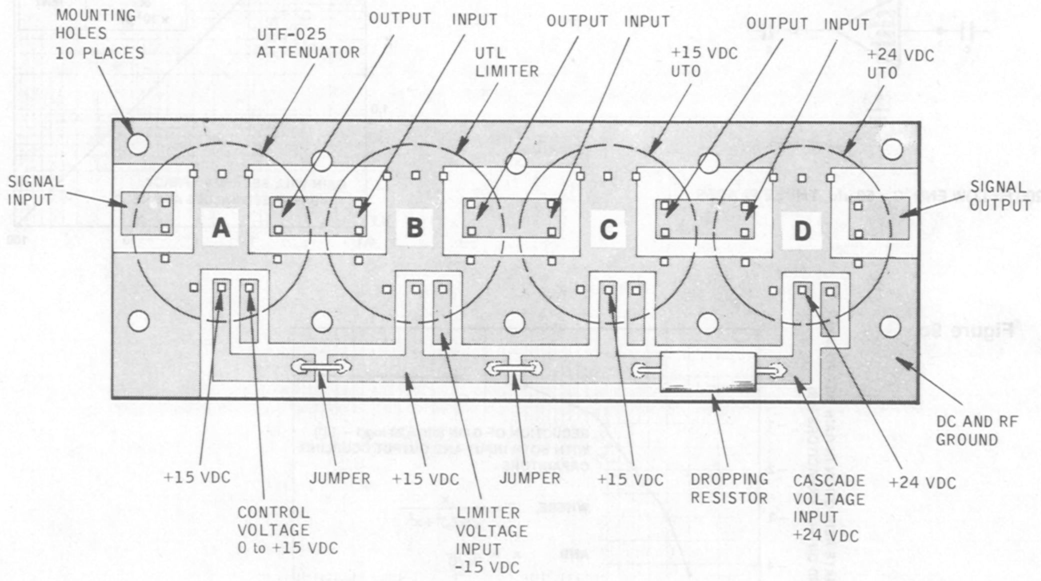
The figure shows how the modules are installed and connections made. Position A shows the connections to a UTF attenuator; position B, to a UTL limiter amplifier, position C, to a UTO requiring a dropping resistor to lower the available supply voltage and position d, to a UTO operating directly from the available supply voltage. Note the use of jumpers when dropping resistors are not required.

All connections to the pins on the modular devices are made via conductors on the bottom, or circuit, side of the board. The top, or ground plane, is left completely clad except for the clearances milled around the holes drilled to pass device pins to prevent unintentional short circuits.

Since the ground plane side of the board is left completely clad, it assures both a good ground and effective heat sink when modules are clamped to it. Modules may also be secured with conductive epoxy or other means, so long as the cases are in intimate thermal and electrical contact with the ground plane.

On the conductor side of the board, all of the unused conductor areas are effectively interconnected to the ground plane and the entire board is grounded to the case or chassis via mounting hardware. In addition a "straight line" circuit layout assures that there will be a minimum of coupling between module inputs and outputs.

Figure 10. Avantek TB-4 Microstrip Board (Showing Connections to Modules)



Bypassing of DC Leads

It is always a good practice to provide RF bypassing of power and control leads entering the PC board, particularly when the power supply and control circuitry is located some distance away. This practice will prevent unwanted signals and externally-generated noise from entering the cascade.* RF chokes or ferite beads on the input power and control leads as well as noninductive bypassing capacitors of approximately 0.001 to 0.1 μf installed at the bias pins of each of the modules should prevent any possibility of noise ingress or RF feedback.**

Assembly Instructions for Avantek TB Board and TC Case

The steps listed below and figures 11a, b and c apply to the assembly of TO-8 modules into Avantek TB Series printed circuit boards and TC Series cases.

1. Cut all four pins to a length of approximately 3/16 inch.
2. Insert modules into TB Series printed circuit board. As the board is viewed from the circuit side, as in figure b, the module selected for input is placed on the left.
3. Bend the module leads slightly to hold the unit loosely to the board. Do not solder until after Step 7.
4. Place the board, with module attached, into the TC Series case in the manner shown in figure c.
5. With the 0-80 × 3/16 stainless pan head screws provided, secure the board firmly to the case. (This step insures proper contact between the module and the circuit board ground plane for both RF stability and heat dissipation.)
6. Install the DC feed-through(s), ground terminal and connectors.
7. Bend module leads flat against the printed circuit, as shown in figure b. Then solder.

Assembly Instructions for Customer-supplied Circuit Board

The steps below apply only to the assembly of Avantek modules into microstrips or stripline circuits other than Avantek TB Series printed circuit boards. CAUTION: The Avantek modules are designed for use in a 50-ohm microstrip system and the package must be adequately grounded!

1. After cutting the pins per step 1 install the module directly on the circuit board ground plane with the RF Input, RF Output and DC Voltage pins (see figure 11) passing through the board to the circuit on the other side. Be careful that these pins do not short out to the ground plane.
2. Using the clamp provided, secure the module firmly to the ground plane. Figures d and e show the proper positioning and installation of the mounting clamp. (This step insures positive contact between the module package and the ground plane so that no problems with VSWR or oscillations in a multistage system will be encountered.)
3. Bend the RF Input, RF Output, DC Voltage and GND pins flat against the proper portions of the printed circuit. Then solder in place.

8. Wiring:
   a. If only modules with the same DC supply voltage are used, simply solder jumper wires between the DC voltage lines of the adjacent stages. Then, solder another wire between the DC voltage feed-through and the DC voltage line adjacent to it.
   b. If modules of different supply voltages are cascaded, varying DC bias voltages become a factor. If all units are biased from the same supply, provision must be made to drop the high voltage supplied to the lower voltage. The appropriate resistor is soldered on the DC voltage line between stages where the high to low voltage transition occurs. Then, jumper wires are soldered between the DC voltage lines of the other adjacent stages. Finally, a wire is soldered between the DC voltage feed-through and the DC voltage line adjacent to it.

---

* Bias and control pins of Avantek TC series cases, and UTC factory-assembled and packaged cascades are provided with by-passing.

** In a few cases, small chokes or ferrite beads on the jumpers carrying power between modules on the PC board may be advisable as well—particularly on high gain cascades where feedback between stages is occasionally experienced.

Figure 11. Assembly Procedures for MICamp Amplifier Cascades

Figure a

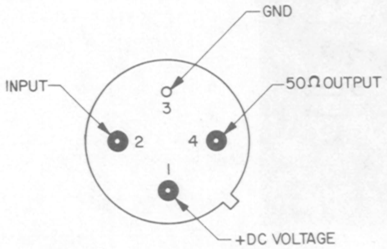
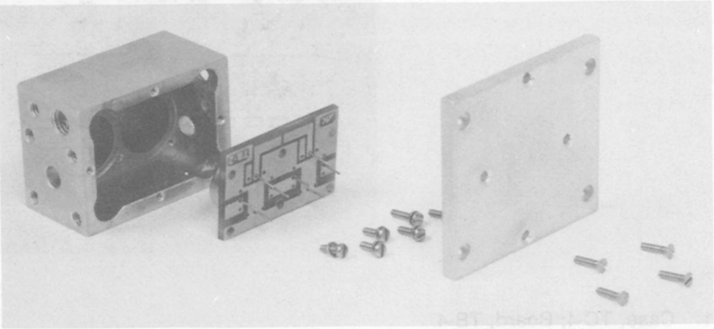


Figure c



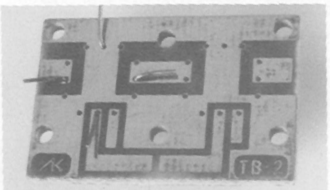


Figure b

Avantek
UTO-509

Figure d

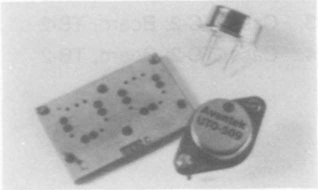


Figure e

Materials Supplied

Customers can purchase modules, printed circuit boards and cases individually or as factory-integrated assemblies. Materials supplied with specific orders are as follows:

If you order	Shipment will include*
1. Individual modules	Module Mounting Clamp Clamp Screws, Nuts, Washers
2. TB Series Circuit Board(s)	Circuit Boards(s) Circuit Board Mounting Screws
3. TC Series Cases(s)	Case(s) Case Cover Case Cover Mounting Screws DC Feed-through, Washer Ground Terminal, Washer Connectors (specify type)

Figure 12. Circuit Boards (shown actual size)

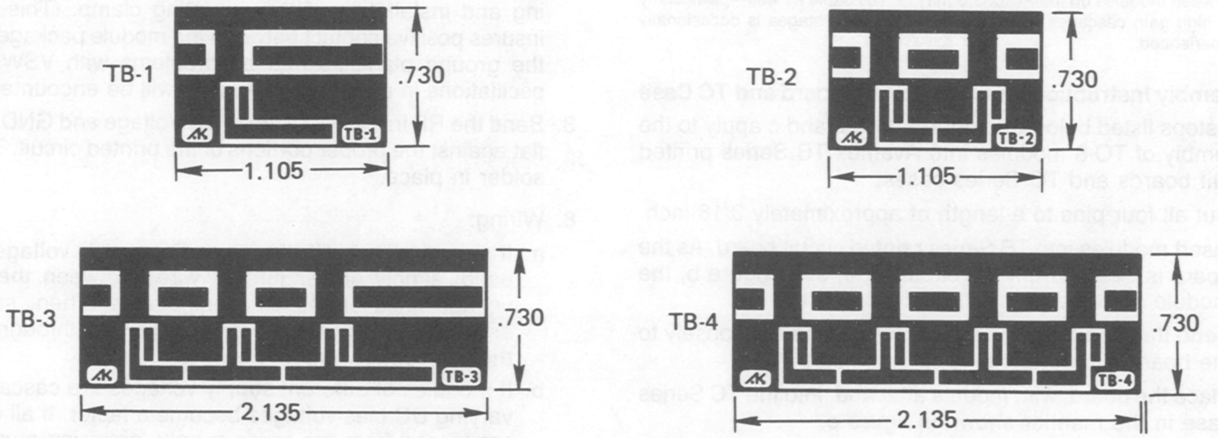
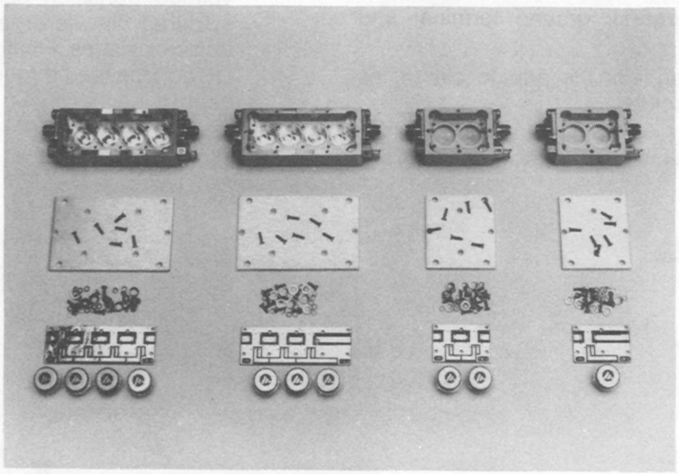


Figure 13. Typical Assemblies

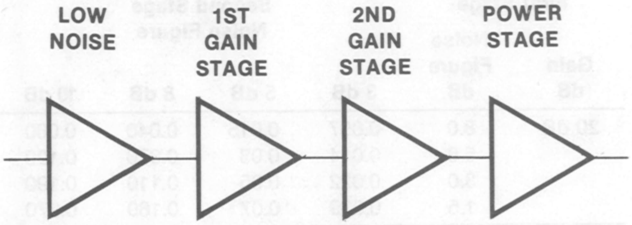


1. Case, TC-4; Board, TB-4
2. Case, TC-4; Board, TB-3
3. Case, TC-2; Board, TB-2
4. Case, TC-2; Board, TB-2

CASCADED PERFORMANCE

With over 100 Avantek thin-film amplifier modules from which to choose, it is simple to design a cascade offering practically any required combination of performance characteristics.

Figure 14. Typical Cascade of Amplifier Modules.



In most cases, the first module is selected to provide the required cascade noise figure and the final module to provide the necessary cascade output power. If additional gain is required, intermediate modules are included—taking care to assure that the power output of each intermediate module is high enough to sufficiently drive the following stage, yet not so high that it will cause saturation. The entire cascade design process is very straightforward, with quite accurate results possible by simply using a few "rules of thumb," as listed below:

Bandwidth

Since cascading does not affect the bandwidth of the individual modules, the overall bandwidth of a cascade will be defined by the module having the *smallest* bandwidth. Note, though, that the bandwidths specified for each modular amplifier is the guaranteed operating frequency range, and the modules will provide significant amounts of gain at much lower and usually much higher frequencies.

Gain

The minimum gain of a cascade will be the sum of the minimum gains of each of the cascaded modules *so long as none of the modules are driven into saturation* by signal levels applied to the cascade.

Gain Flatness

The following table provides a conservative estimate of the overall gain flatness of a cascade, based on the number and type of modules used.

Figure 15. Approximate Gain Flatness of Avantek Modular Amplifiers.

	Bandpass Flatness in dB No. of Gain Stages		
UTO Series	**2 ea**	**3**	**4**
500	± 1.0	± 1.5	± 2.0
1000	± 1.0	± 1.5	± 2.0
1500	± 1.0	± 1.5	± 2.0
2000	± 1.5	± 2.0	± 2.5

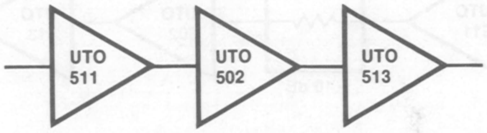
Noise Figure

The noise figure of a cascade can be calculated from the usual equation

$$F_C = F_1 + \frac{F_2 - 1}{G_1} + \frac{F_3 - 1}{G_1 G_2} + \dots \frac{F_N - 1}{G_1 G_2 \dots G_{N-1}}$$

Where F_1 and F_N are the noise figures (in numeric form, $F = \log^{-1}\frac{NF_{dB}}{10}$) of the 1st and Nth stages respectively and G_1 and G_N are the gains (in numeric form, $G = \log^{-1}\frac{G_{dB}}{10}$)of the 1st and Nth stages.

Referring to the noise figure equation, the noise figure of a cascade consisting of a UTO-511, UTO-502 and UTO-513 is:



UTO-511	$G = 31.62$ (15 dB) $NF = 2.5$ dB, $F = 1.778$
UTO-502	$G = 25.12$ (14 dB) $NF = 5.5$ dB, $F = 3.55$
UTO-513	$G = 39.81$ (16 dB) $NF = 6.0$ dB, $F = 3.98$

$$F_C = 1.778 + \frac{3.55 - 1}{31.62} + \frac{3.98 - 1}{(31.62)(25.12)} = 1.862$$

$NF_C = 2.701$ dB

Overall gain = 15 dB + 14 dB + 16 dB = 45 dB

The first stage of a cascade contributes the bulk of the noise figure. In this case,

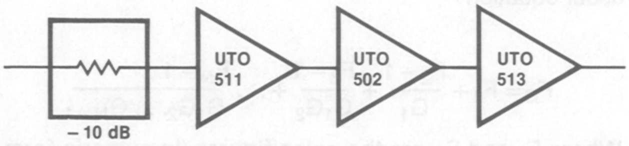
First stage NF contributuion = 2.5 dB (2.5 dB NF amplifier)

Second stage contribution = 0.192 dB (5.5 dB NF amplifier)

Third stage contribution = 0.009 dB (6.0 dB NF amplifier)

When a fixed, variable or electrically-variable attenuator (such as one of the UTF Series) or an unintentional loss is inserted in an amplifier cascade, its overall effect on the system noise figure will vary with its position in the cascade. The loss of the attenuator (in dB) adds directly to the noise figure of the succeeding amplifier stage—for example, a 2.5 dB NF UTO-511 preceded by 10 dB of loss will exhibit an overall 12.5 dB noise figure. This effect is demonstrated in the following example, which consists of the same UTO cascade as previously investigated, with the addition of a 10 dB attenuator placed in various positions.

1st STAGE

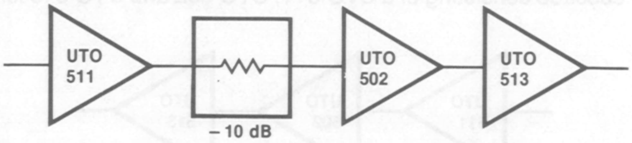


$$NF\ UTO\text{-}511 = 10\ dB + 2.5\ dB = 12.5\ dB\quad F = 17.78$$

$$F_C = 17.78 + \frac{3.55 - 1}{31.62} + \frac{3.98 - 1}{(31.62)(25.12)} = 17.86$$

$NF_C = 12.5$ dB $\qquad G_C = 35$ dB

2nd STAGE

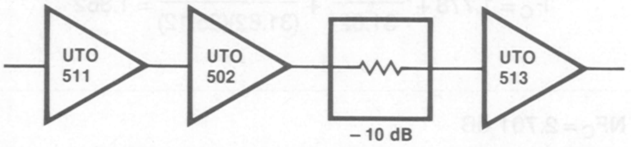


$$NF\ UTO\text{-}502 = 10\ dB + 5.5\ dB = 15.5\ dB = 35.48$$

$$F_C = 1.778 + \frac{35.4 - 1}{31.62} + \frac{3.98 - 1}{(3.162)(25.12)} = 2.871$$

$NF_C = 4.58$ dB $\qquad G_C = 35$ dB

3rd STAGE

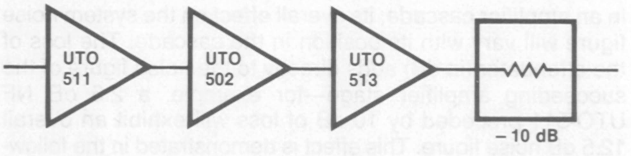


$$NF\ UTO\text{-}513 = 10\ dB + 6.0\ dB = 16\ dB = 39.81$$

$$F_C = 1.78 + \frac{3.55 - 1}{31.62} + \frac{39.81 - 1}{(3.162)(25.12)} = 2.87$$

$NF_C = 2.8$ dB $\qquad G_C = 35$ dB

4th STAGE



NF = same as w/o attenuator

$G_C = 35$ dB

As a general rule, the noise figure contribution of subsequent stages will be rather small if the gain of the first module is greater than approximately 15 dB.

Figure 16. Second Stage Noise Contribution.

First Stage		Second Stage Noise Figure			
Gain dB	Noise Figure dB	3 dB	5 dB	8 dB	10 dB
20 dB	8.0	0.007	0.015	0.040	0.060
	5.0	0.014	0.03	0.070	0.120
	3.0	0.022	0.05	0.110	0.190
	1.5	0.039	0.07	0.160	0.270
15 dB	8.0	0.220	0.047	0.114	0.190
	5.0	0.043	0.093	0.225	0.370
	3.0	0.068	0.146	0.351	0.580
	1.5	0.096	0.205	0.488	0.800
10 dB	8.0	0.07	0.150	0.350	0.580
	5.0	0.14	0.290	0.670	1.090
	3.0	0.21	0.450	1.030	1.620
	1.5	0.30	0.620	1.390	2.140
7 dB	8.0	0.140	0.290	0.670	1.090
	5.0	0.270	0.560	1.260	1.950
	3.0	0.410	0.850	1.850	2.790
	1.5	0.570	1.160	2.430	3.560

If the gain of the first stage is less than 15 dB, the noise figure of the second stage will make a significant contribution to the overall noise figure of the cascade. For example, if a UTO-546 is cascaded with a UTO-544

Model #	Noise Figure	Gain
UTO-544	3.0 dB	10 dB
UTO-546	8.0 dB	10 dB

its noise contribution would be 1.03 dB and the noise figure of the cascade would be 4.03 dB.

On the other hand, if a higher-gain amplifier such as the UTO-517 is cascaded with the UTO-507 the second stage contribution is not as great.

Model #	Noise Figure	Gain
UTO-517	3.0 dB	22 dB
UTO-507	8.5 dB	14 dB

The second stage contribution would be only approximately 0.11 dB and the noise figure of the cascade would be 3.11 dB.

Mathematically, the overall noise figure of a cascade of amplifiers will always be lower if the second stage amplifier is also a low-noise amplifier. However such a cascade *will not* provide a higher output compression, and most important will not be as stable over temperature. For example, the UTO-502 only has a gain variation of 0.3 dB over the – 55 to +85°C temperature at 400 MHz whereas the UTO-510 has a 0.8 dB gain variation. Moreover, the reduction in noise figure in going from a UTO-510/UTO-510 cascade to a UTO-510/UTO-502 is only 0.07 dB.

The need to cascade two low-noise, low-level amplifiers would be in those applications where current drain is critical or where the second stage amplifier is expected to provide some limiting.

Power Output

In the usual cascade, when the amplifier modules are arranged in order of ascending output power (i.e., the output power of each stage matches the input power requirements of the following stage), the minimum output power of the cascade will be no worse than 1 dB less than the guaranteed output power of the last module alone. For example, if the following two amplifiers were cascaded:

Model #	Power Output 1 dB Comp. (dBm)	Gain (dB)	Input Power 1 dB Comp. (dBm)
UTO-502	+7.0	14	−7.0
UTO-509	+20.0	13	+7.0

the estimated 1 dB compression point for the cascade would be +19.0 dBm.

On the other hand, if there is a differential between the output power of the driver amplifier and the input compression point of the following stage then the power output of the last stage needs to be degraded by the differential plus 1.0 dB. For example if the following two amplifiers were cascaded:

Model #	Power Output 1 dB Comp. (dBm)	Gain (dB)	Input Power 1 dB Comp. (dBm)
UTO-543	+6.0	10	−4.0
UTO-509	+20.0	13	+7.0

the estimated 1 dB compression point for the cascade would be +18 dBm.

Theoretically if the driver amplifier provides sufficient input power, there should be *no degradation* in output power of the last amplifier in a cascade. However, this requires driver amplifiers having an output power approximately *5 dB greater* than the input compression point (guaranteed output power *minus* module gain) of the following module. For example, if a UTO-503 is to be driven to its full +13 dBm output power, the driving stage should be rated for +9 dBm output power, the driving stage should be rated for +9 dBm output power [+13 dBm −9 dB (stage gain) +5 dB (excess drive)].

Input Power

In the previous noise figure cascade, suppose the fixed 10.0 dB attenuator is replaced by the UTF-025 voltage controlled attenuator. Attenuation can then be varied over a 2 to 35 dB attenuation range to maintain the output power of the cascade at a constant +14 dBm (1 dB compression point for the UTO-513). Locating the attenuator near the input port of the cascade controls the signal power level applied to the entire cascade, while moving it toward the output will permit earlier stages to saturate on high input signals. The location will prove important in AGC loop and other gain leveling applications. See tables on the facing page.

Assuming that

(1) UTF-025 is varied through the 2 to 35 dB attenuation range

(2) No stage may be permitted to provide more than its 1 dB gain compression point output power (i.e., no stage may approach saturation)

In summary, the maximum input power range is when the UTF-025 attentuator is placed between the first and second gain stages.

Location of UTF-025 in the Cascade	Input Power Level Range (dBm)	Attenuation Range (dB)	Output Power (dBm)
1st Stage	−29 to +4	33	+14
2nd Stage	−29 to +4	33	+14
3rd Stage	−29 to −22	7	+14

Third Order Two-Tone Intercept Point

When cascading amplifiers, a 3 dB reduction in the output intercept point of the output stage will occur if the driving amplifier output intercept point is equal to the input intercept point of the output amplifier. As a conservative rule, a 5 dB differential is required between the output intercept point of the driving amplifier and the input intercept point of the output amplifier to preserve the output intercept point of the cascade. To calculate the overlap, refer to the typical curves of the third-order, two-tone intercept point for each amplifier. The intercept point is often quite sensitive to frequency and should be calculated on a "worst case frequency" basis.

VSWR

The Avantek cascadable amplifiers have been designed to operate in a 50-ohm system. Both the input and output impedance of each amplifier is carefully matched to 50 ohms by use of collector-to-base and emitter resistive feedback. Resistive values are stabilized through high temperature heat treating, and very precisely set with laser trimming. Impedance matching at the upper 1½ octaves of the band is achieved through LC matching and reactive feedback compensation. In cascade applications, there may be some VSWR degradation in the upper 1½ octaves of the band. However in the lower portion of the amplifier's bandwidth there is virtually no VSWR degradaton due to cascading several amplifiers.

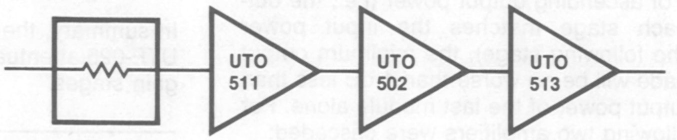
Phase Linearity

When several amplifier stages are cascaded, the phase response deviations are algebraicallyl additive. The deviations will tend to cancel at certain frequencies and add at others.

As a rule of thumb: The worst case phase nonlinearity of a cascade of UTO, UTF and UTL modules will be approximately equal to the sum of the average phase nonlinearities of the individual modules. For example, if three modules are added with typical phase non-linearities of ±2°, ±3° and 4°, an estimate of the overall phase nonlinearity as ±9° will represent the worst case.

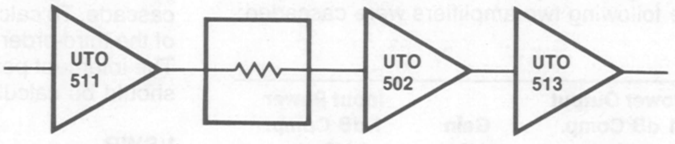
For a more accurate determination of the actual phase characteristics of a cascade, the completed cascade should be measured using the automatic network analyzer or other technique.

1st STAGE


UTO
511
UTO
502
UTO
513

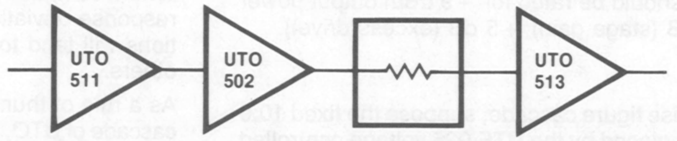
Gain (dB)		−2 to −35		15		14		16	
Output Power (dBm)				−2		+7		+14	
Input Power (dBm)				−17		−7		−2	
Input Power of Cascade for +14 dBm Power Output (dBm)									
For Min Attn	−29		−31		−16		−2		+14
For Max Attn	+4		−31		−16		−2		+14

2nd STAGE


UTO
511
UTO
502
UTO
513

Gain (dB)		15		−2 to −35		14		16	
Output Power (dBm)		−2		—		+7		+14	
Input Power (dBm)		−17		—		−7		−2	
Input Power of Cascade for +14 dBm Power Output (dBm)									
For Min Attn	−29		−14		−16		−2		+14
For Max Attn	+4		+19		−16		−2		+14

3rd STAGE


UTO
511
UTO
502
UTO
513

Gain (dB)		15		14		−2 to −35		16	
Output Power (dBm)		−2		+7		—		+14	
Input Power (dBm)		−17		−7		—		−2	
Input Power of Cascade for +14 dBm Power Output (dBm)									
For Min Attn	−29		−14		0		−2		+14
For Max Attn	−22		−7		+7		−2		+14

Group Delay

The group delays of the production samples of UTO MICamp amplifiers are less than 1 ns per stage (the UTO-504, -521, and -523 have two stages, and the UTO-1521 has three) and relatively constant over the entire operating bandwidth.

Since there is no appreciable interaction between the group delay of UTO, UTF and UTL devices when they are operated in a conventional 50-ohm microstrip environment, the total group delay of a cascade of these modules will be approximately equal to the sum of their individual group delays (plus the group delay introduced by transmission line sections), $t_d \cong t_{d_1} + \ldots t_{d_n}$.

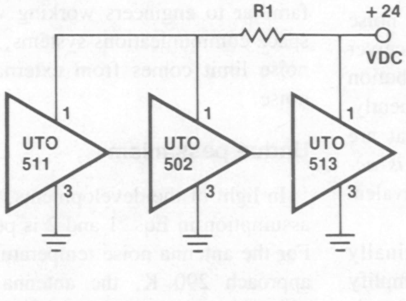
DC Bias

The minimum and maximum specification of any cascadable amplifier is guaranteed only when the bias voltage is supplied at the rated value ± 1% regulation. Other bias voltages may be used, allowing the designer to tailor the performance of the amplifier to his requirements. For example, referring to the typical gain curves, it can be seen that by decreasing the input voltage of a UTO-503 from its rated 24 volts to 15 and 12 volts, the noise figure can be reduced from 6.0 dB at 800 MHz to approximately 5.5 and 5.1 dB respectively. However, this noise figure reduction is accompanied by a reduction in output power available from 16.1 dBm (1 dB gain compression point) to 11.1 and 8.0 dBm.

When several amplifiers requiring different bias voltage are used in a cascade, they may be powered from a single input voltage, so long as the power source provides a voltage equal to or higher than the highest required by the modules and is capable of supplying the total current requirements of the cascade. Each amplifier or amplifier cascade requiring a lower input voltage can be supplied by dropping the voltage with a series resistor. Since each amplifier behaves as a constant current sink under normal linear operating conditions, the resistor will not affect power supply regulation.

The value of the dropping resistor may be determined from R = , where the E is the voltage required by amplifier or amplifiers subtracted from the source voltage and I is the total current consumed by the stages being supplied at that voltage. The power dissipation of the resistor may be determined by $P = I^2R$.

As an example, referring to the cascade presented previously, the UTO-513 operates from 24 VDC, and the UTO-502 and 511 from 15 VDC.



FOR UTO-511 and UTO-501

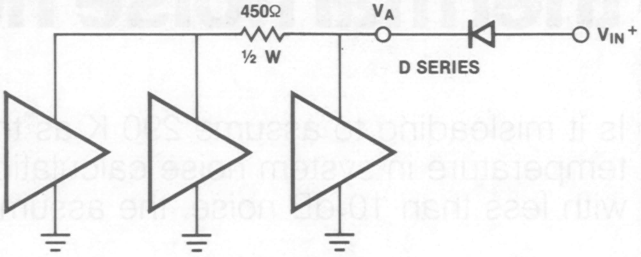
$V = 15V$

$I = 10\text{ mA} + 10\text{ mA} = 20\text{ mA}$

$$R_1 = \frac{24-15}{20 \times 10^{-3}} = \frac{9}{20 \times 10^{-3}} = 450\Omega$$

When such dropping resistors are used, it is recommended that a 0.1 μF capacitor be installed (with the shortest possible leads) between the module power terminal and ground to assure adequate RF bypassing.

The UTO, UTL and UTF modules do not contain over-voltage or reverse-voltage protection, so in instances where there is a possibility of reverse voltage being applied to a cascade, it may be advisable to add a series diode.



If a series silicon diode is used, the approximately 0.6V drop may usually be ignored, since the UTO current drain is constant and a 0.6V decrease in input voltage will not have appreciable effect on performance (in this example the available voltage has only decreased by 2.5%).

The bias lead of all amplifiers except for the "60 Series" GPD and 3-pin header GPD amplifier have an internal 6800 pF bypassing capacitor. In some applications, such as cascades with extremely large gains (in excess of 60 dB), further bypassing of the bias supply leads of individual modules may be required to eliminate cascade oscillation. Placement of a 0.1 μF capacitor (noninductive) on the bias line to ground is recommended.

Where lies the thermal noise floor?

Is it misleading to assume 290 K as the proper standard noise temperature in system noise calculations? For receivers operating with less than 10-dB noise, the assumption can be costly.

Terry Harper, Senior Systems Engineering Manager, Avantek, Inc., 481 Cottonwood Dr., Milpitas CA 95035, and **John Grebenkemper,** Development Engineering Manager, Tandem Computers, Inc., 2550 Walsh Ave., Santa Clara, CA 95050

THE thermal noise floor is a starting point for most engineers concerned with the noise performance of microwave earth-station receiving systems. This reference noise level is generally computed by assuming a value of 290 K as the standard noise temperature at the input of the receiver. This assumption, however, may have led any number of engineers down the road to ruin. Systems components have gotten better through the years and may exceed the expected 290 K in many cases.

Let's review the facts. The standard method calculates the noise power of a microwave receiver, referred to its input, according to

$$P_T = (kT_0B)F \qquad (1)$$

where

P_T = the input noise power (in μW);

k = Boltzmann's constant, expressed as 1.38×10^{-23} J/K;

T_0 = the standard noise temperature (290 K);

B = the bandwidth (in MHz); and

F = the receiver's noise figure.

In Eq. 1, kT_0 is the noise power (in W/Hz) available from a test resistor at temperature T_0. The relationship can also be written (in decibels) as

$$P_T = -114 + 10 \log B + NF \text{ (dBM)} \qquad (2)$$

$$P_T = NF - 114 \text{ (dBm/MHz)} \qquad (3)$$

where

NF = 10logF.

Designers using this formula may not realize that they are summing the noise power at the input terminals of the receiver with an assumed noise-power contribution of kT_0B from the antenna. Consequently, the calculations generate results that are valid *only when the antenna noise is actually −114 dBm/MHz* (which is equivalent to 290 K).

High-frequency engineers originally made the 290 K assumption to simplify noise calculations. This approximation is based on the idea that the receiver is terminated in a so-called "matched load" at its input. In addition, the 290 K temperature has customarily been considered insignificant because the noise floor of the receiving system has almost invariably been limited by the noise generated within the system itself. In the past, this noise did make the predominant contribution to the noise power at the receiver input.

The availability of the low-noise preamplifiers (Fig. 1) in today's market, however, translates into quieter receiver inputs than in the past. As a result, a receiver often has less noise than the antenna, a fact familiar to engineers working with deep-space communications systems, where the noise limit comes from external galactic noise.

Undue pessimism

In light of the developments, the 290 K assumption in Eqs. 1 and 2 is pessimistic. For the antenna noise temperature to even approach 290 K, the antenna must be pointed at a "warm" earth (about 20°C). A high-gain antenna pointed at its zenith may exhibit a noise temperature of only 10 to 30 K (mostly from sky noise).

In many microwave antennas, about 80 percent of the received power comes from the main lobe.[1] When the main lobe of the antenna beam is pointed at positions other than the zenith, the warm-earth sidelobe noise may be small, as long as the antenna does not directly "see" the earth. The only exception occurs when the antenna is operating in an atmospheric absorption band, where the antenna noise may indeed approach 290 K.

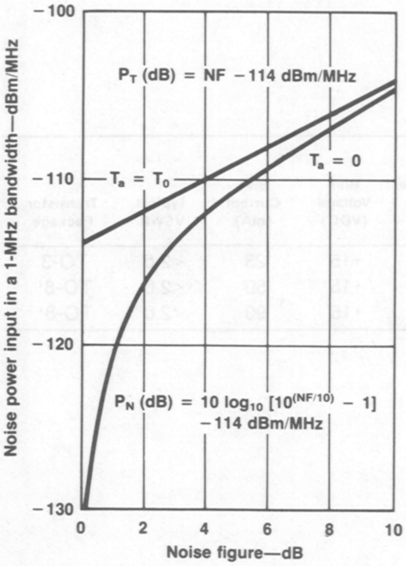
Component and subsystem design engineers who add antenna noise to the receiver front-end noise submit themselves to an unnecessary evil. They should calculate the noise power for the receiver alone. The total noise power calculations should be left to the system designer who can determine a correct value for the antenna noise power, based on that system's application.

Recalculating noise

A more valid expression for the noise power generated by a receiver at its input terminals must include a relationship between the effective noise temperature of the receiver (T_e) and the standard noise temperature (T_0). The Friis formula[2] is a good place to start:

$$F = \frac{S_i/N_i}{S_o/N_o} \qquad (4)$$

$$F = \frac{S_i/N_i}{G\,S_i/(N + G\,N_i)} \qquad (5)$$



The revised relationship for noise power *(lower curve) differs considerably from the traditional function (upper trace) at low noise figures. The new curve is based on Eq. 14.*

$$F = \frac{(N + GN_i)}{G\,N_i} \qquad (6)$$

where

S_i = the signal power delivered to the receiver input port;

N_i = the noise power delivered to the receiver input port;

S_0 = the signal power delivered at the receiver output;

N_0 = the noise power delivered at the receiver output;

G = the receiver gain; and

N = the noise power generated by the receiver at its output.

By definition, the noise power generated by the receiver referred to its input is

$$P_N = kT_eB = \frac{N}{G} \qquad (7)$$

By substituting into Eq. 6, it is possible to arrive at

$$F = \frac{(kT_eB + N_i)}{N_i} \qquad (8)$$

The true noise figure of the receiver depends greatly on the noise power delivered to its input port. For this reason, the IEEE (as suggested by Friis) has standardized on a resistive load at T_0 (290 K) as the source of noise power delivered to the receiver during noise figure measurements.[3] As a result,

$$N_i = kT_0B \qquad (9)$$

By substituting Eq. 9 into Eq. 8, this becomes

$$F = \frac{(T_e + T_0)}{T_0} \qquad (10)$$

If this equation is solved for the effective noise temperature of the receiver, it resolves to

$$T_e = (F-1)\,T_0 \qquad (11)$$

where it is understood that F is measured by injecting a noise power of kT_0B into the receiver input.

Having revised these relationships, the expression for the noise power generated by the receiver referred to its input (Eq. 7) can be written as

$$P_N = kT_0B\,(F-1) \qquad (12)$$

or (in decibels) as

$$P_N = -114 + 10\log B + 10\log(10^{NF/10} - 1)(\text{dBm}) \qquad (13)$$

$$P_N = 10\log(10^{NF/10} - 1) - 114(\text{dBm/MHz}) \qquad (14)$$

The noise power predicted by Eq. 14 is plotted in Fig. 2 along with the noise power generated from the traditional noise relationship (Eq. 3). For a receiver noise figure much greater than 10 dB, the difference between the two expressions becomes negligible. However, for lower noise figures, the difference can be significant. For a 3-dB noise figure, for example, there is a 3-dB error in the predictions from Eq. 3. This corresponds to the condition where $T_e = T_0$.

In a practical sense, the microwave system design engineer will always be dealing with an input noise power that lies somewhere between the two curves of Fig. 2. If the contribution from the load impedance terminating the receiver output is ignored, this can be expressed by the following equation:

$$P_T = P_N + P_A \qquad (15)$$

where

$P_A = kT_aB$ and

T_a = the antenna noise temperature (in K). Substituting from Eq. 12, this becomes

$$P_T = kT_0B[F + (T_a/T_0) - 1] \qquad (16)$$

where

$F = 10^{NF/10}$. This can also be written in decibels as

$$P_T = -114 + 10\log B + 10\log[10^{NF/10} + (T_a/T_0) - 1]\ (\text{dBm}) \qquad (17)$$

$$P_T = 10\log[10^{NF/10} + (T_a/T_0) - 1] - 114\ (\text{dBm/MHz}) \qquad (18)$$

If the system design engineer can make a good estimate of T_a, then Eqs. 16 through 18 can provide the total equivalent power at the receiver input. If the assumption that $T_a = 0$ is made, the expressions reduce to the correct expression for the noise power generated by the receiver at its input, namely, Eqs. 12 through 14.

The curves shown in Fig. 2 can serve as a correction factor for noise power measurements made with a standard load at T_0. A system designer should examine an application and estimate the true antenna noise temperature, particularly when a low-noise preamplifier can set a receiver at a noise figure of less than 10 dB.● ●

References

1. Lamont V. Blake, "Low Noise Receiving Antennas," *MicroWaves*, March 1966, pp. 18-27.
2. H. T. Friis, "Noise Figures of Radio Receivers," *Proceedings of the IRE*, July 1944, pp. 419-422.
3. "Description of the Noise Performance of Amplifiers and Receiving Systems," sponsored by the IRE Subcommittee 7.9 on Noise, *Proceedings of the IEEE*, March 1963, pp. 436-442.

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Application Notes

AGC AMPLIFIER

5-300 MHz APPLICATIONS

The Avantek AGC-330 is a unique combination of a thin-film cascadable amplifier and fast response attentuator. Compact and inexpensive, it offers the equivalent of two or three separate TO-8 modules in a single TO-3 package.

Used alone the AGC-330 can be a complete AGC-controlled IF amplifier, suitable for a variety of extremely compact receivers with intermediate frequencies in the 5 to 300 MHz range. It may also be combined with additional stages of wideband modular amplifier modules, such as the Avantek UTO-500 or GPD Series, to produce a voltage-controlled amplifier with any reasonable amount of gain and power output. Used with modular amplifiers, the AGC-330 will not degrade the frequency response of a cascade.

10-1000 MHz APPLICATIONS

The Avantek® AGC-553 and AGC-1053 are thin-film amplifiers with a wide range of voltage-controlled gain, in very compact hermetically sealed TO-8 packages. Model AGC-553 has a frequency range of 10 to 500 MHz, provides 44 dB of small signal gain, an AGC range of 45 dB, typical output power of 0 dBm at 1 dB gain compression and typical noise figure of 6 dB. AGC-1053 has a frequency range of 10 to 1000 MHz, provides 22 dB of small signal gain with an AGC range of 35 dB, has output power of typically 8 dBm at 1 dB gain compression and has a typical noise figure of 11 dB.

Both amplifiers are built with three cascaded Avantek MODAMP™ silicon monolithic amplifier chips (MMICs) in cascade with interstage PIN diode attenuators on a single alumina substrate. The MMICs are only 0.4 × 0.4 mm square, and each combines two silicon bipolar transistors with f_T's of 10 GHz in a Darlington pair with on-chip bias resistors, and series and shunt feedback networks. Because of the negative feedback and extremely small size of the MMICs, the resulting amplifiers have very good thermal stability and low group delay. Three of these monolithic amplifier chips are die attached to an alumina substrate along with the interstage coupling capacitors and PIN diode chips. The associated resistive attenuator network is fabricated as part of the thin-film circuit process.

Since the gain of the AGC-553 (−1 to +45 dB) and the AGC-1053 (−13 to +22 dB) is programmed with a 0 to +5 volt DC control voltage, it is simple and practical to design it into systems controlled by standard TTL digital logic, making it ideal for computer-controlled receiving systems.

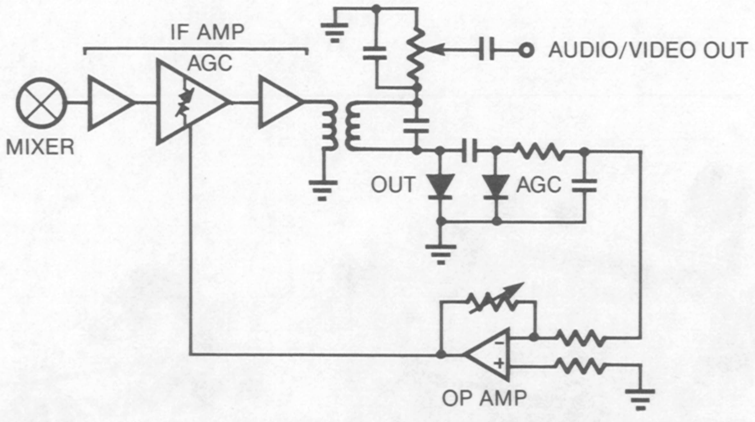
AGC SERIES

Guaranteed Specifications at 25° C Case Temperature

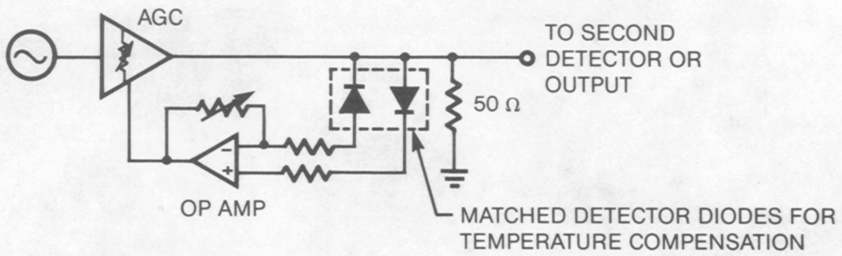
Model	Frequency Response (MHz)	Gain (dB) Typ./Min.	AGC Range (dB) Typ.	AGC Voltage Range (Volts)	AGC Current Range (mA)	Maximum[2] Noise Figure (dB) Typ./Max.	Power Output at 1 dB Gain Compression (dBm) Minimum	Typical Response Time (μsec)	Bias Voltage (VDC)	Bias Current (mA)	Typical VSWR	Transistor Package
AGC-330	5-300	22/20	36	0 to 5	0 to 30	4.0/5.0	0	1.5	+15	25	<2.0	TO-3
AGC-553	10-500	44/40	45	0 to 5	0 to 12	6.0/8.0	−4	25	+15	50	<2.0	TO-8[1]
AGC-1053	10-1000	22/18	35	0 to 5	0 to 12	11.0/12.0	+5	25	+15	90	<2.0	TO-8[1]

Notes 1: 5 PIN CASE.
2: At 0 AGC.

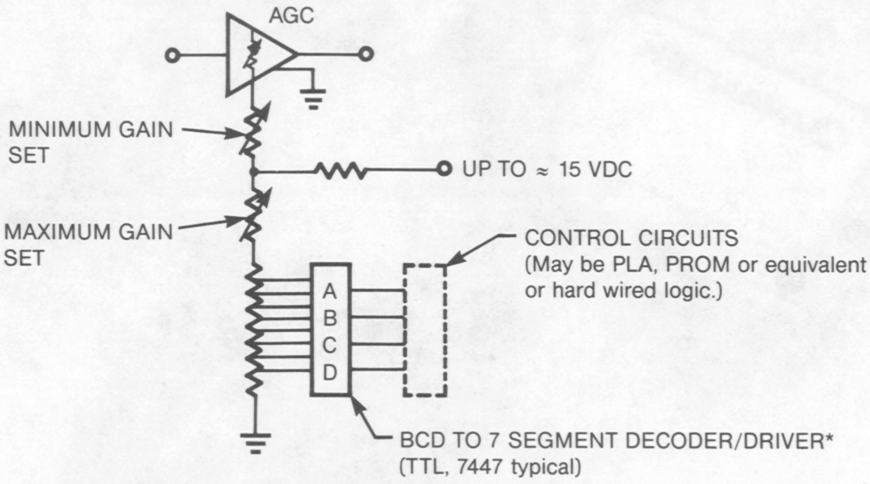
TYPICAL APPLICATIONS FOR THE AGC SERIES


IF AMP
AGC
MIXER
AUDIO/VIDEO OUT
OUT
AGC
OP AMP
-
+

LOW FREQUENCY IF WITH AGC-553 AS GAIN CONTROL


AGC
TO SECOND DETECTOR OR OUTPUT
50 Ω
OP AMP
-
+
MATCHED DETECTOR DIODES FOR TEMPERATURE COMPENSATION

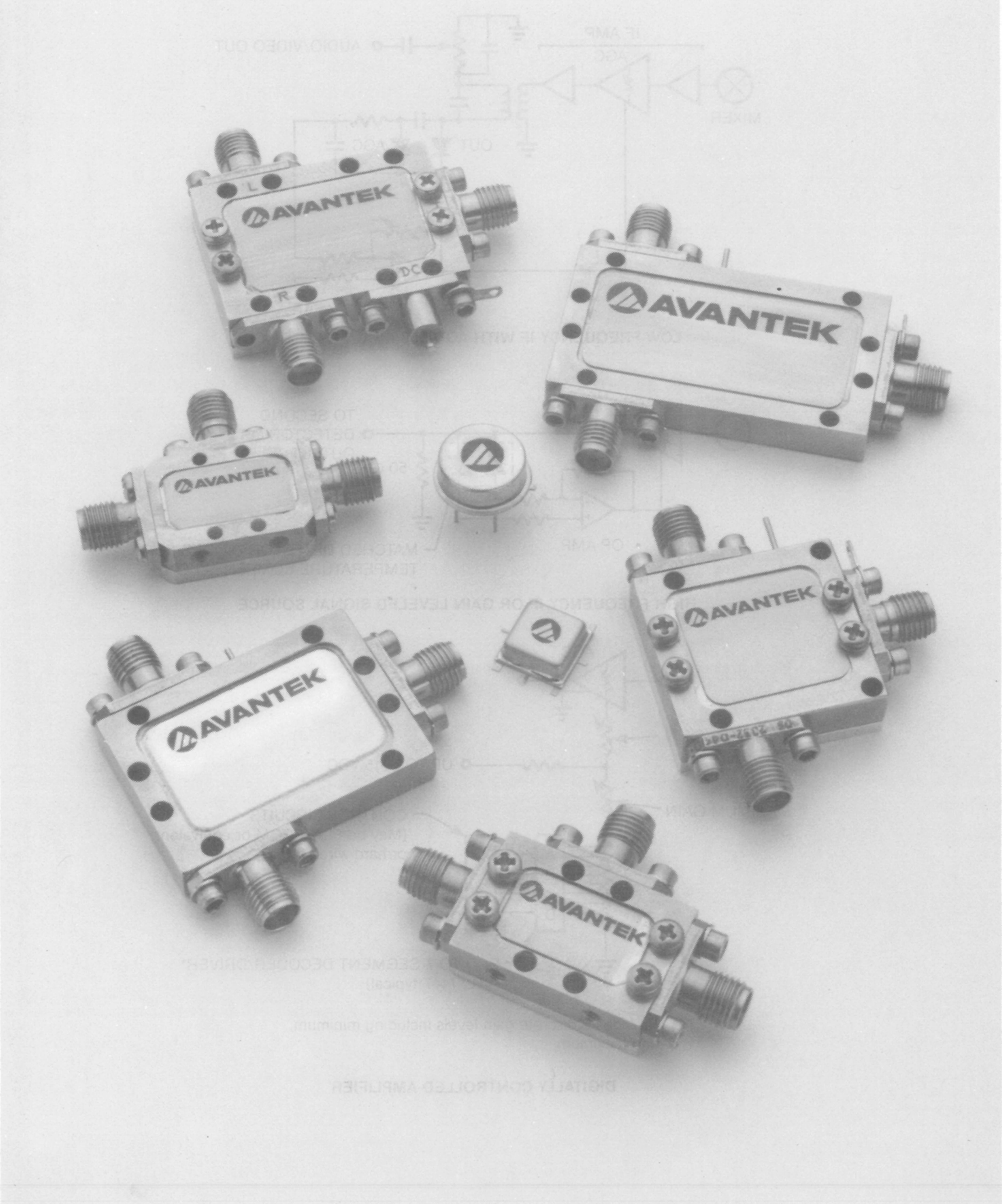
HIGH FREQUENCY IF OR GAIN LEVELED SIGNAL SOURCE


AGC
MINIMUM GAIN SET
UP TO ≈ 15 VDC
MAXIMUM GAIN SET
CONTROL CIRCUITS (May be PLA, PROM or equivalent or hard wired logic.)
A
B
C
D
BCD TO 7 SEGMENT DECODER/DRIVER* (TTL, 7447 typical)

*Provides 8 discrete gain levels including minimum and maximum.

DIGITALLY CONTROLLED AMPLIFIER

PRODUCT DATA


AVANTEK
L
R
DC
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• MIXERS & MIXER-PREAMPLIFIERS

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- Glossary of Mixer Terms 310

See Page 4 for a complete Alphanumeric Listing of Modular Products.

Product Descriptions

AVANPAK DOUBLE BALANCED MIXERS

Avantek's Double Balanced Mixers, the DBX/DBY Series, cover the frequency range .05 to 26 GHz with various IF response frequencies ranging from DC to 12 GHz.

All DBX/DBY mixers feature high isolation, relatively low conversion loss and a good 50-ohm match (low VSWR) at all ports for ease of integration with other RF components.

The DBX/DBY Series uses precisely matched Schottky-barrier diodes and a "quasi-planar" physical construction for excellent overall symmetry. Construction techniques result in high LO to RF isolation, extremely low single tone intermodulation distortion and very good amplitude and phase match characteristics.

Applications include use in threat warning self protection jammers and wideband heterodyned receivers. This series is also ideal for narrowband low IF frequency requirements.

These mixers are supplied in Avanpak DBX and DBY cases. The DBY is a smaller version of the DBX and is used in compact stripline/microstrip systems. The DBY offers all of the same performance and reliability advantages of the DBX package.

AVANPAK MIXER-PREAMPLIFIERS

The MXA Series of Avanpak mixer-preamplifiers integrates Avantek's mixer and thin-film amplifier products into a miniature microwave flatpack.

MXA devices cover the frequency range from .05 to 18 GHz on the R and L ports with IFs up to 6 GHz.

Virtually any combination of selected mixers and amplifiers may be cascaded to meet customer needs. All combinations are packaged in Avanpak MA-X or SA-X cases which are small size and light weight and can be used for coax, stripline or microstrip applications.

PLANARPAK™ SURFACE MOUNT MIXER

The PPM-2515M is a triple balanced surface mount mixer with a frequency range of .05 to 2.5 GHz and an IF range of .001 to 1.5 GHz.

This PlanarPak mixer uses precisely matched monolithic beam lead Schottky diodes and polyimide insulated baluns to yield excellent performance over more than five octaves of RF and LO bandwidths. With overlapping RF, LO and IF frequency ranges there is still greater than 25 dB of port-to-port isolation. IF bandwidths up to 1500 MHz are obtained with very flat conversion loss. Good 50 ohm match is realized at all ports.

The PPM-2515M is supplied in the newly designed surface mount package which allows the use of simpler microstrip installation at higher densities and improved performance.

UMX DOUBLE BALANCED MIXERS

Avantek's UMX Series of double balanced mixers covers the frequency range 1 to 5500 MHz with various IF response frequencies ranging from DC to 1300 MHz.

The UMX Series features high isolation and good harmonically-related intermodulation product suppression.

The UMX double balanced mixers have been designed for low cost/high performance applications. They are supplied in the hermetically sealed TO-8 metal/glass package.

Selection Guide

Avanpak Double Balanced Mixers (Typical Specifications @ 25°C Case Temperature)

Model DBX/DBY[1]	Frequency Range RF & LO (GHz)	Frequency Range IF (GHz)	Conversion Loss (dB)	Isolation LO to RF (dB)	Isolation LO to IF (dB)	VSWR RF Port	VSWR LO Port	Page No.
3503M/H	.05–3.0[2]	.001–3.0	8.0	30	35	2.0	2.0	284
72L/M/H	2–7	DC–1.3	6.0	35	25	2.5	1.7	256
824M/H	2–8	.005–4.0	6.5	25	30	2.0	2.0	274
1221L/M/H	2–12	DC–1.3	6.0	35	25	2.5	2.0	278
158L/M/H	8–15	DC–1.0	6.0	30	20	2.0	1.7	258
167L/M/H	7–16	DC–4.0	6.5	30	20	2.0	1.7	260
184L/M/H/LS/MS/HS	4–18	DC–4.0[3]	6.5	30	20[3]	2.5	2.0	264
185L/M/H	5–18	DC–6.0	6.5	30	20	2.5	2.0	268
186L/M/H	6–18	DC–7.0	7.0	30	20	2.5	2.0	270
1824M/H	2–18	.005–4.0	7.0	25	30	2.5	2.0	280
18212M/H	2–18[4]	0.5–12	7.5	30	20	2.5	2.0	286

Notes 1: Case dimensions: DBX = .96 × .66 × .22; DBY = .80 × .59 × .19
2: LO = .05–3.5 GHz.
3: LS/MS/HS suffix has 30 dB typ Lo to IF isolation & IF response to 1.5 GHz for swept frequency applications.
4: LO = 2–26 GHz.

Avanpak Mixer-Preamplifiers (Guaranteed Specifications @ 25°C Case Temperature)

Model Number	Consisting of the Following Products	Frequency Range RF (GHz)	Frequency Range LO (GHz)	Frequency Range IF (MHz)	RF-IF Gain (dB) Min.	Noise Figure (dB) Typ.	Power Output for 1 dB Gain Compression (dBm) Min.	DC Current (mA) Typ.	Page No.
MXA-2512	DBX-3503, UTO-210, UTO-210	.5–2.0	.5–2.0	10–200	10	11	8	30	288
MXA-3012	DBX-3503, UTO-1012, UTO-1013	.05–3.0	.05–3.5	10–1000	22	10.5	9	50	288
MXA-3013	DBX-3503, UTO-1012, UTO-1013, UTO-1006	.05–3.0	.05–3.5	10–1000	33	10.5	17	120	288
MXA-7202	DBX-72M, UTO-514, UTO-516	2–7	2–7	30–160	22	8.5	9	45	288
MXA-7203	DBX-72M, UTO-514, UTO-519, UTO-509	2–7	2–7	30–160	33	8.5	20	135	288
MXA-8203	DBX-1824, UTO-210, UTO-210, UTO-210	2–8	2–8	10–200	18	11	12	45	288
MXA-10911	DBX-186M, UTO-222	9–10	9–10	70	20	9	19	50	288
MXA-18422	DBX-184M, UTO-2012, UTO-2012	4–18	4–18	500–2000	9	11.5	12	100	288
MXA-18423	DBX-184M, UTO-2012, UTO-2012, UTO-2013	4–18	4–18	500–2000	18	11.5	19	200	288
MXA-18662	DBX-18212M, AFT-6232	6–18	8–16	2000–6000	9	12	10	100	288
MXA-18663	DBX-18212M, AFT-6233	6–18	8–16	2000–6000	18	12	10	150	288
MXA-18803	DBX-1824, UTO-210, UTO-210	8–18	8–18	10–200	10	11	8	30	288
MXA-18201	DBX-1824M, UTO-222	2–18	2–18	10–200	18	10.5	20	50	288
MXA-18202	DBX-1824M, UTO-511, UTO-516	2–18	2–18	10–250	22	9.5	9	45	288
MXA-18203	DBX-1824M, UTO-511, UTO-516, UTO-509	2–18	2–18	10–250	37	9.5	20	135	288
MXA-18241	DBX-1824M, AFT-4231	2–18	2–18	2000–4000	2	11.5	2	50	288

PlanarPak™ Surface Mount Triple Balanced Mixer (Typical Specifications @ 25°C C Case Temperature)

Model	Frequency Range RF/LO (GHz)	Frequency Range IF (GHz)	Conversion Loss (dB)	Isolation LO to RF (dB)	Isolation LO to IF (dB)	VSWR RF + IF Port	VSWR LO Port	Page No.
PPM-2515(P)	.05–2.5/3.0	.001–1.5	7.6	35	35	1.5	2.5	290

(P) Preliminary

UMX Mixer Selection Guide (Typical Specifications @ 25°C Case Temperature)

Model	Frequency Range RF & LO (GHz)	Frequency Range IF (GHz)	Conversion Loss (dB)	Isolation LO to RF (dB)	Isolation LO to IF (dB)	VSWR RF Port	VSWR LO Port	Page No.
UMX-520	1–500	DC–500	6.0	55	45	1.7	2.5	292
UMX-570[1]	1–500	DC–500	5.5	35	45	1.7	3.0	294
UMX-2020	10–2000	DC-1000	7.0	40	30	2.0	3.0	296
UMX-4220	3700–4200[2]	DC-1300	5.0	35	25	1.5	1.5	298

Notes 1: +27 dBm LO drive, +32 dBm intercept point.
2: LO = 2400–5500 MHz.

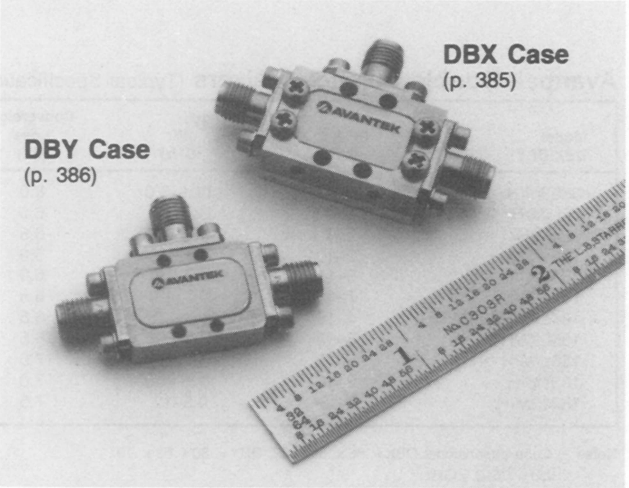
DBX-72L/M/H
DBY-72L/M/H

Avanpak
Double Balanced Mixer
2.0-7.0 GHz

AVANTEK

FEATURES

- **5.5 dB Conversion Loss**
- **35 dB Isolation**
- **Low VSWR**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic		Operating Frequencies, GHz			Power Level			Specifications		Unit
			f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range		2.0–70	2.0–70	DC–1.5						GHz
CL	SSB Conversion Loss		2.0–7.0	2.0–7.0	DC–0.5	+7 to +13	L		5.5	7.5	dB max
			2.0–7.0	2.0–7.0	DC–1.2	+10 to +17	M		6.5	8.6	
			2.0–7.0	2.0–7.0	DC–1.5	+17 to +24	H		7.5	9.5	
NF	SSB Noise Figure		2.0–7.0	2.0–7.0	0.03–0.5	+6 to +8	L		5.5	7.5	dB max
			2.0–7.0	2.0–7.0	0.03–1.2	+10 to +13	M		6.5	8.5	
			2.0–7.0	2.0–7.0	0.03–1.5	+17 to +20	H		7.5	9.5	
ISOL	Isolation Port-to-Port	L-R	2.0–3.0	—	—				25	20	dB min
		L-R	3.0–7.0	—	—				35	25	
		R-L	—	2.0–7.0	—				35	—	
		R-I	—	2.0–7.0	—				20	—	
		L-I	2.0–7.0	—	—				25	20	
—	VSWR (50 ohm)	L	2.0–7.0	—	—				1.7:1		max
		R	4.0–7.0	—	—				1.5:1		
		R	2.0–3.0	—	—				3.0:1		
		R	3.0–4.0	—	—				2.0:1		
		I	—	—	≤1.5				1.5:1		
CC	Conversion Compression Point		2.0–7.0	2.0–7.0	≤1.5	≥+7	L	0	0.5	1.0	dBm max
			2.0–7.0	2.0–7.0	≤1.5	≥+10	M	+4			
			2.0–7.0	2.0–7.0	≤1.5	≥+17	H	+10			
IP_3	Third-Order Two-Tone Intercept Point		2.0–7.0	2.0–7.0	≤1.5	≥+7	L	—	+9	—	dBm typ
			2.0–7.0	2.0–7.0	≤1.5	≥+10	L	—	+10	—	
			2.0–7.0	2.0–7.0	≤1.5	≥+17	M	—	+12	—	
			2.0–7.0	2.0–7.0	≤1.5	≥+20	H	—	+22	—	

MAXIMUM RATINGS

Peak Input Current @ 25°C	100 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	-55°C to +100°C
Storage Temperature	-65°C to +100°C
Continuous RF Input Power	200 mW @ +25°C 100 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

TYPICAL PERFORMANCE AT 25°C

Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

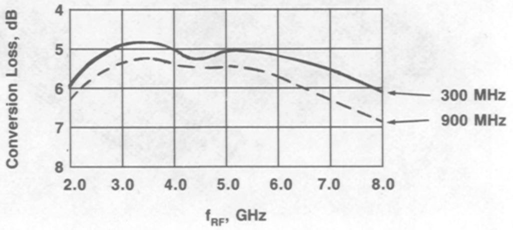
Harmonics of f_{RF}	1	2	3	4
4	>70	>70	>70	>70
3	65	>70	55	>70
2	50	55	50	58
1	0	25	18	40

Harmonics of f_{LO}

Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at −10 dBm and f_{LO} signal level of:

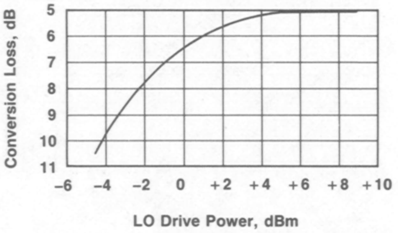
L Suffix	+7 dBm
M Suffix	+10 dBm
H Suffix	+17 dBm

Conversion Loss



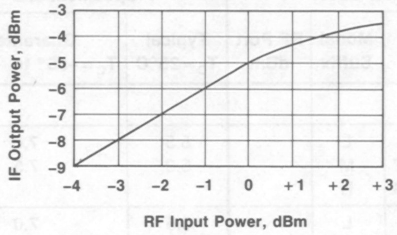
Conversion Loss

$f_{FO} = 4.1$, $f_{RF} = 4.0$ GHz

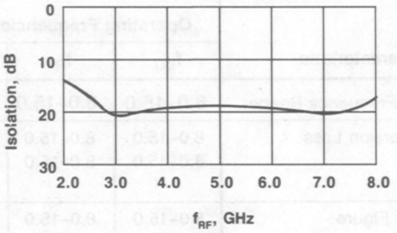


IF Output vs. RF Input Level

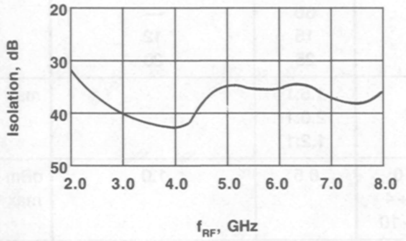
LO = +7.0 dBm



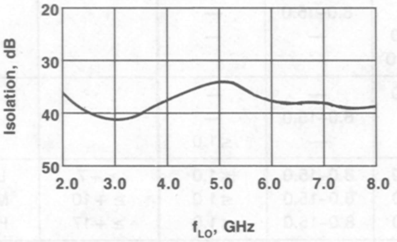
R Port to I Port Isolation



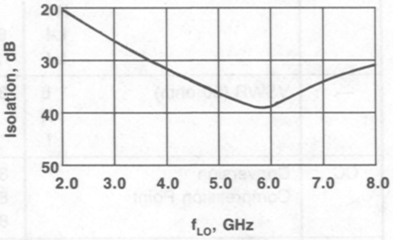
R Port to L Port Isolation



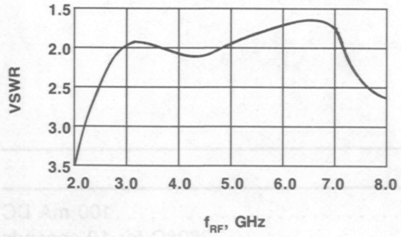
L Port to R Port Isolation



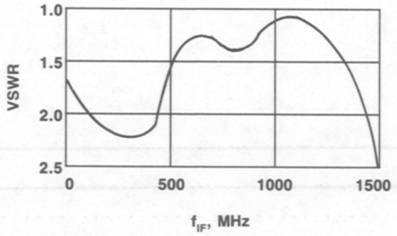
L Port to I Port Isolation



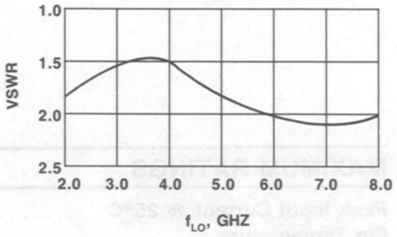
R Port VSWR



I Port VSWR



L Port VSWR



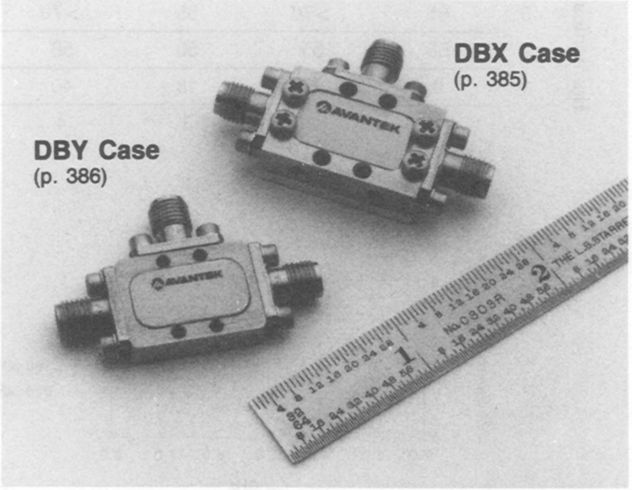
DBX-158L/M/H
DBY-158L/M/H

Avanpak
Double Balanced Mixer
8-15 GHz

AVANTEK

FEATURES

- **5.5 dB Conversion Loss**
- **R Port VSWR ≤2.0:1**
- **30 dB Isolation**



DBX Case
(p. 385)

DBY Case
(p. 386)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

						Power Level			Specifications		
			Operating Frequencies, GHz								
Symbol	Characteristic		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	Unit
BW	Operating Frequency Range		8.0–15.0	8.0–15.0	DC–1.0						GHz
CL	SSB Conversion Loss		8.0–15.0	8.0–15.0	DC–0.5	+7 to +13	L		5.5	7.0	dB
			8.0–15.0	8.0–15.0	DC–1.0	+10 to +17	M		6.0	7.5	max
						+17 to +24	H				
NF	SSB Noise Figure		8.0–15.0	8.0–15.0	0.03–0.5	+6 to +8	L		5.5	7.0	dB
			8.0–15.0	8.0–15.0	0.03–1.0	+10 to +13	M		6.0	7.5	max
						+17 to +20	H				
ISOL	Isolation Port-to-Port	L-R	8.0–15.0	—	—				30	20	dB
		R-L	—	8.0–15.0	—				25	—	min
		R-I	—	8.0–15.0	—				30	—	
		L-I	8.0–12.0	—	—				15	12	
		L-I	12.0–15.0	—	—				25	20	
—	VSWR (50 ohm)	L	8.0–15.0	—	—				1.5:1		max
		R	—	8.0–15.0	—				2.0:1		
		I	—	—	≤1.0				1.2:1		
CC	Conversion		8.0–15.0	8.0–15.0	≤1.0	≥+7	L	0	0.5	1.0	dBm
	Compression Point		8.0–15.0	8.0–15.0	≤1.0	≥+10	M	+4			max
			8.0–15.0	8.0–15.0	≤1.0	≥+17	H	+10			
IP_3	Third-Order		8.0–15.0	8.0–15.0	≤1.0	≥+10	L	—	+9	—	dBm
	Two-Tone		8.0–15.0	8.0–15.0	≤1.0	≥+17	M	—	+10	—	typ
	Intercept Point		8.0–15.0	8.0–15.0	≤1.0	≥+20	H	—	+20	—	

MAXIMUM RATINGS

Peak Input Current @ 25°C	100 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	-55°C to +100°C
Storage Temperature	-65°C to +100°C
Continuous RF Input Power	200 mW @ +25°C 100 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

TYPICAL PERFORMANCE AT 25°C

Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

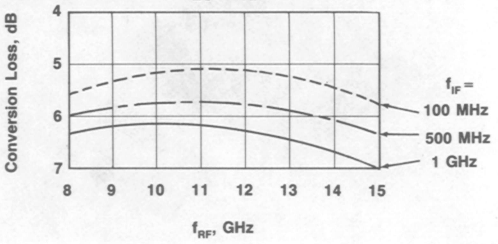
Harmonics of f_{RF}				
4	>70	>70	>70	>70
3	65	>70	55	>70
2	50	55	50	58
1	0	25	18	40
	1	2	3	4

Harmonics of f_{LO}

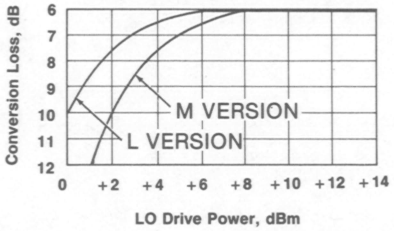
Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at – 10 dBm and f_{LO} signal level of:

L Suffix . . . . + 7 dBm
M Suffix . . . . + 10 dBm
H Suffix . . . . + 17 dBm

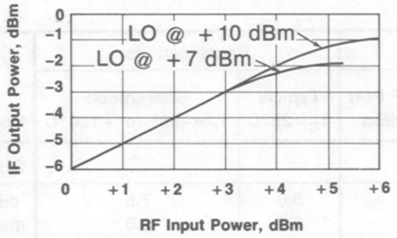
Conversion Loss
$f_{LO} < f_{RF}$



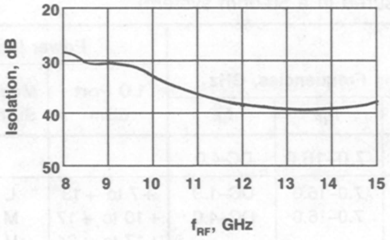
Conversion Loss
f_{FO} = 12 GHz, f_{RF} = 12.5 GHz



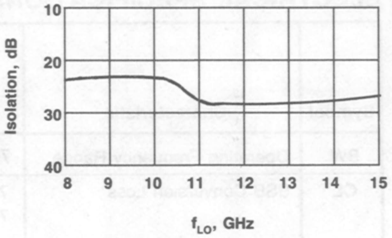
IF Output vs. RF Input Level



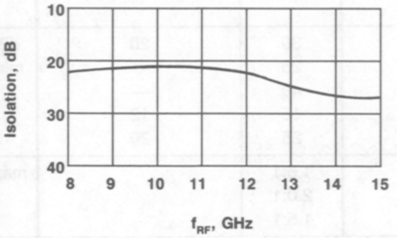
R Port to I Port Isolation



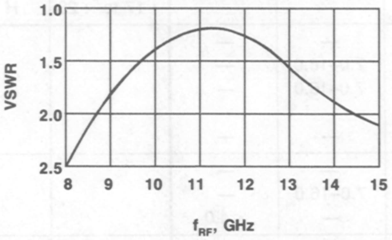
L Port to R Port Isolation



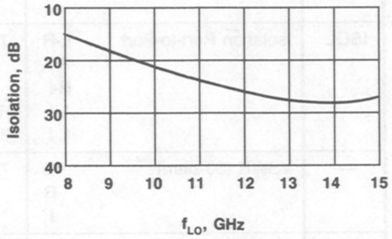
R Port to L Port Isolation



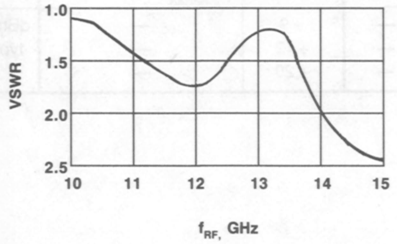
R Port VSWR
f_{IF} = 400 MHz, $f_{LO} > f_{RF}$



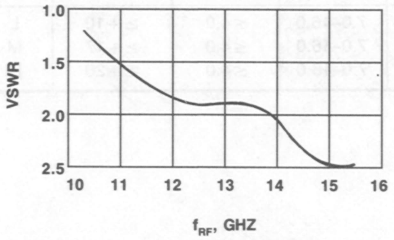
L Port to I Port Isolation



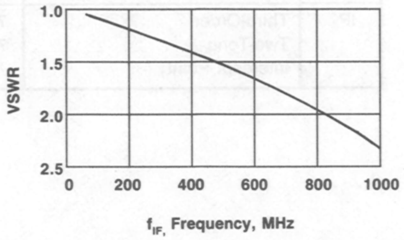
R Port VSWR
f_{LO} = 9 GHz



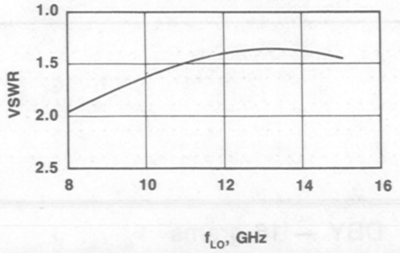
R Port VSWR
f_{LO} = 10 GHz



I Port VSWR



L Port VSWR



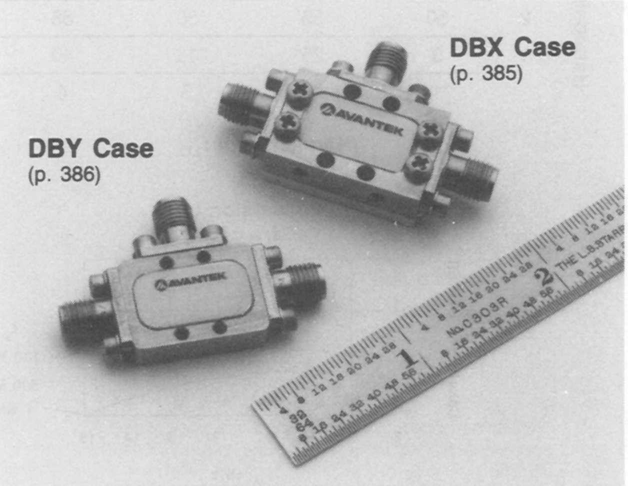
DBX-167L/M/H
DBY-167L/M/H

Avanpak
Double Balanced Mixer
7-16 GHz

AVANTEK

FEATURES

- DC to 4.0 GHz
- 5.5 dB Conversion Loss
- R Port VSWR <2.0:1
- 30 dB Isolation



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic		Operating Frequencies, GHz			Power Level			Specifications		Unit
			f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range		7.0–16.0	7.0–16.0	DC-4.0						GHz
CL	SSB Conversion Loss		7.0–16.0	7.0–16.0	DC–1.0	+7 to +13	L		6.0	7.5	dB
			7.0–16.0	7.0–16.0	DC–4.0	+10 to +17	M		6.5	8.0	max
						+17 to +24	H				
NF	SSB Noise Figure		7.0–16.0	7.0–16.0	0.03–1.0	+6 to +8	L		6.0	7.5	dB
			7.0–16.0	7.0–16.0	0.03–4.0	+10 to +13	M		6.5	8.0	max
						+17 to +20	H				
ISOL	Isolation Port-to-Port	L-R	7.0–16.0	—	—				30	20	dB
		R-L	—	7.0–16.0	—				25	—	min
		R-I	—	7.0–16.0	—				40	—	
		L-I	7.0–8.0	—	—				15	12	
		L-I	8.0–16.0	—	—				25	20	
—	VSWR (50 ohm)	L	7.0–16.0	—	—				1.5:1		max
		R	—	7.0–16.0	—				2.0:1		
		I	—	—	≤4.0				1.5:1		
CC	Conversion		7.0–16.0	7.0–16.0	≤4.0	≥ +7	L	0	0.5	1.0	dBm
	Compression Point		7.0–16.0	7.0–16.0	≤4.0	≥ +10	M	+4			max
			7.0–16.0	7.0–16.0	≤4.0	≥ +17	H	+10			
IP_3	Third-Order		7.0–16.0	7.0–16.0	≤4.0	≥ +10	L	—	+9	—	dBm
	Two-Tone		7.0–16.0	7.0–16.0	≤4.0	≥ +17	M	—	+12	—	typ
	Intercept Point		7.0–16.0	7.0–16.0	≤4.0	≥ +20	H	—	+20	—	

MAXIMUM RATINGS

Peak Input Current @ 25°C	100 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	−55°C to +100°C
Storage Temperature	−65°C to +100°C
Continuous RF Input Power	200 mW @ +25°C 100 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

TYPICAL PERFORMANCE AT 25°C (continued)

Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

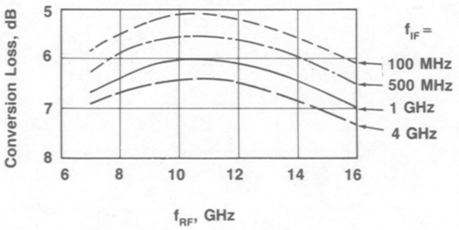
Harmonics of f_{RF}	1	2	3	4	5	6
6	>70	>70	>70	>70	>70	>70
5	>70	>70	>70	>70	>70	>70
4	>70	>70	>70	>70	>70	>70
3	65	>70	60	>70	65	>70
2	55	55	55	58	55	60
1	0	35	18	40	35	45

Harmonics of f_{LO}

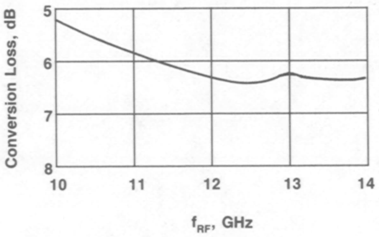
Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at – 10 dBm and f_{LO} signal level of:

L Suffix .... + 7 dBm
M Suffix .... + 10 dBm
H Suffix .... + 17 dBm

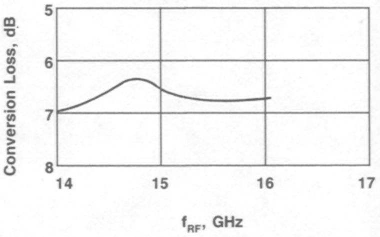
Conversion Loss
$f_{LO} < f_{RF}$



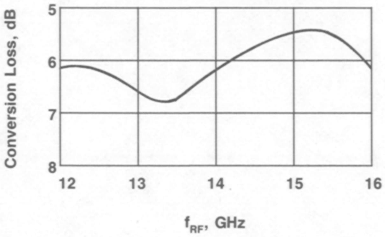
Conversion Loss
f_{IF} = 0.5 GHz-4 GHz
f_{LO} = 10 GHz



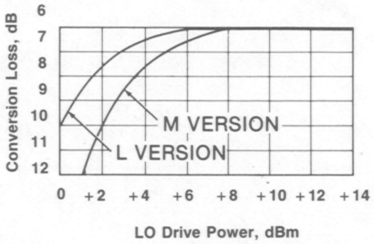
Conversion Loss
f_{IF} = 2-4 GHz, f_{LO} = 12 GHz



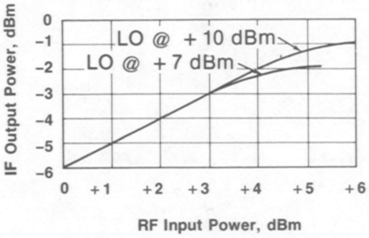
Conversion Loss
f_{IF} = 4.0 GHz-0.5 GHz
f_{LO} = 16 GHz



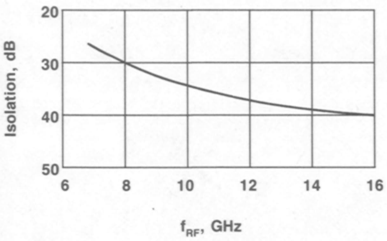
Conversion Loss
f_{LO} = 12 GHz, f_{RF} = 12.5 GHz



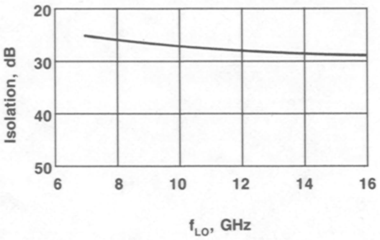
IF Output vs. RF Input Level



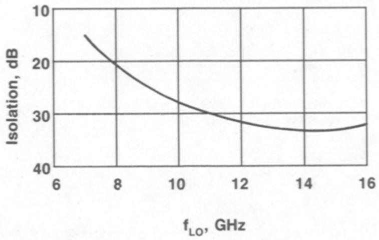
R Port to I Port Isolation



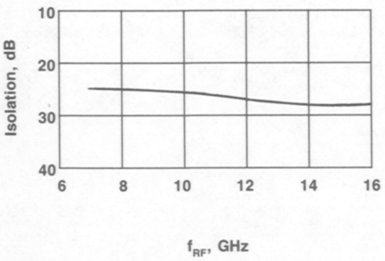
L Port to R Port Isolation



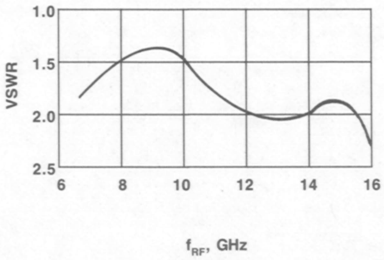
L Port to I Port Isolation



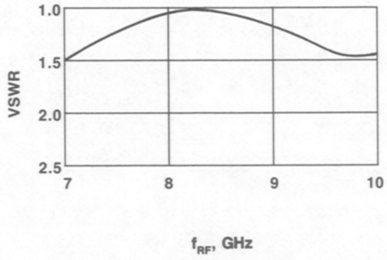
R Port to L Port Isolation



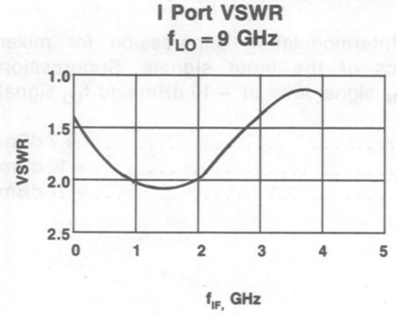
R Port VSWR
f_{IF} = 400 mHz, $f_{LO} > f_{RF}$

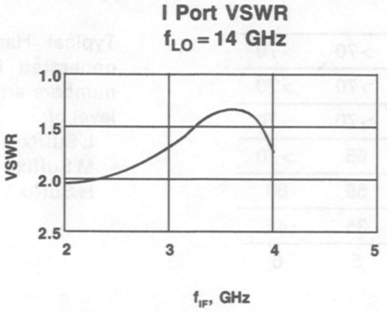


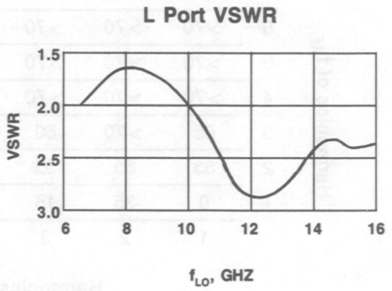
R Port VSWR
f_{LO} = 11 GHz



TYPICAL PERFORMANCE AT 25°C


I Port VSWR
$f_{LO} = 9$ GHz


I Port VSWR
$f_{LO} = 14$ GHz


L Port VSWR

NOTES:

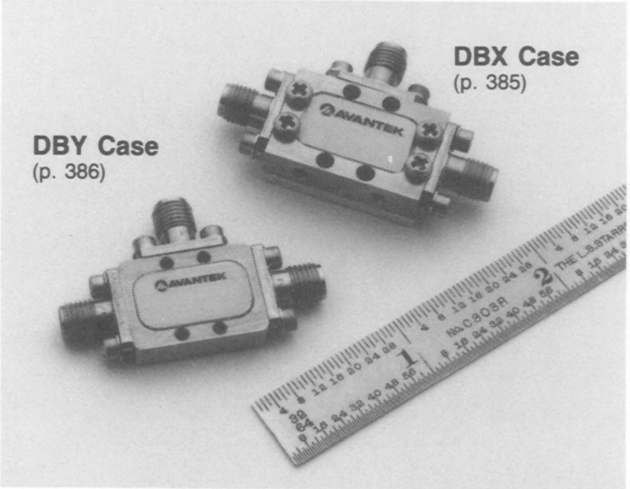
DBX-184L/M/H
DBY-184L/M/H

Avanpak
Double Balanced Mixer
4.0-18.0 GHz

AVANTEK

FEATURES

- **DC—4.0 GHz IF Bandwidth**
- **6 dB Typ. Conversion Loss/NF**
- **30 dB Typ. LO-RF Isolation**
- **Low VSWR**



DBX Case
(p. 385)

DBY Case
(p. 386)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic		Operating Frequencies, GHz			Power Level			Specifications		Unit
			f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range		4.0–18.0	4.0–18.0	DC–4.0						GHz
CL	SSB Conversion Loss		6.0–16.0	6.0–16.0	DC–0.5				6.0	7.5	dB max
			6.0–16.0	6.0–16.0	DC–4.0				6.5	8.5	
			4.0–18.0	4.0–18.0	DC–4.0				7.5	9.0	
NF	SSB Noise Figure		6.0–16.0	6.0–16.0	0.03–0.5				6.0	7.5	dB max
			6.0–16.0	6.0–16.0	0.03–4.0				6.5	8.5	
			4.0–18.0	4.0–18.0	0.03–4.0				7.5	9.0	
ISOL	Isolation Port-to-Port	L-R	4.0–18.0	—	—				30	20	dB min
		R-L	—	4.0–18.0	—				25	—	
		R-I	—	6.0–18.0	—				30	—	
		L-I	4.0–6.0	—	—				10	8	
		L-I	6.0–8.0	—	—				15	12	
		L-I	8.0–18.0	—	—				25	20	
—	VSWR (50 ohm)	L	5.0–17.0	—	—				2.0:1		max
		R	—	4.0–5.0	—				3.0:1		
		R	—	5.0–12.0	—				2.0:1		
		R	—	12.0–18.0	—				1.5:1		
		I	—	—	≤4.0				1.5:1		
CC	Conversion Compression Point		4.0–18.0	4.0–18.0	≤4.0	≥ +7 min	L	0	0.5	1.0	dBm max
			4.0–18.0	4.0–18.0	≤4.0	≥ +10 min	M	+4			
			7.0–16.0	4.0–18.0	≤4.0	≥ +17 min	H	+10			
IP_3	Third-Order Two-Tone Intercept Point		4.0–18.0	4.0–18.0	≤4.0	≥ +10 min	L	—	+9	—	dBm typ
			4.0–18.0	4.0–18.0	≤4.0	+17	M	—	+12	—	
			4.0–18.0	4.0–18.0	≤4.0	≥ +20 min	H	—	+20	—	
—	LO Port Drive Level		4–18	4–18	DC–4	+7 to +13	L				dBm
			4–18	4–18	DC–4	+10 to +17	M				
			4–18	4–18	DC–4	+17 to +24	H				

MAXIMUM RATINGS

Peak Input Current @ 25°C .... 100 mA DC
Pin Temperature .... 260°C for 10 seconds
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −65°C to +100°C
Continuous RF Input Power .... 200 mW @ +25°C
100 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

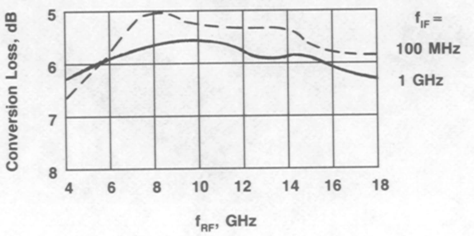
TYPICAL PERFORMANCE AT 25°C

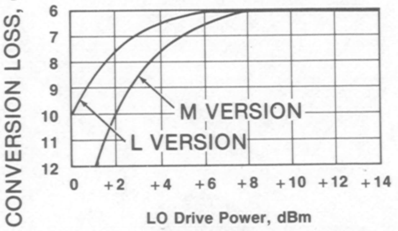
Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

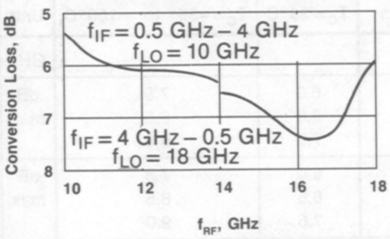
Harmonics of f_{RF}	Harmonics of f_{LO}: 1	2	3	4
4	>70	>70	>70	>70
3	65	>70	55	>70
2	50	55	50	58
1	0	25	18	40

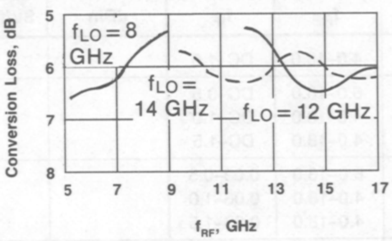
Typical Harmonic Intermodulation Supression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at – 10 dBm and f_{LO} signal level of:

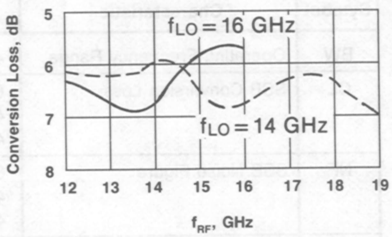
L Suffix . . . . +7 dBm
M Suffix . . . . +10 dBm
H Suffix . . . . +17 dBm

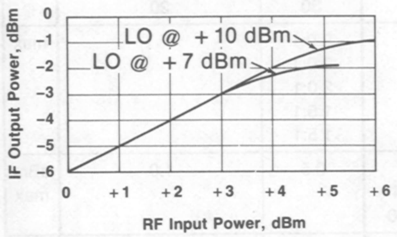

Conversion Loss $f_{LO} < f_{RF}$

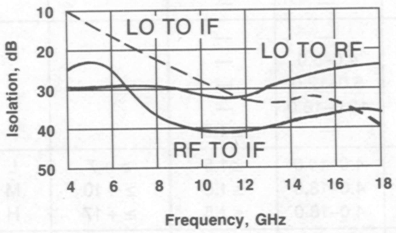

Conversion Loss f_{LO} = 12 GHz, f_{RF} = 12.5 GHz

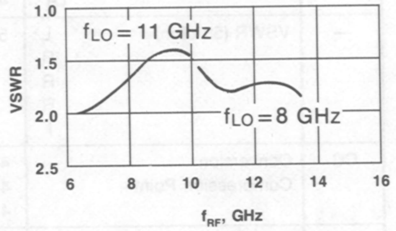

Conversion Loss

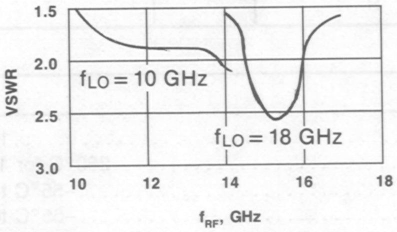

Conversion Loss

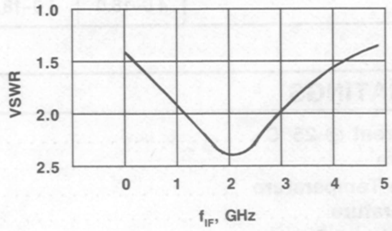

Conversion Loss


IF Output vs. RF Input Level


Port-to-Port Isolation


R Port VSWR


R Port VSWR


I Port VSWR f_{LO} = 9 GHz

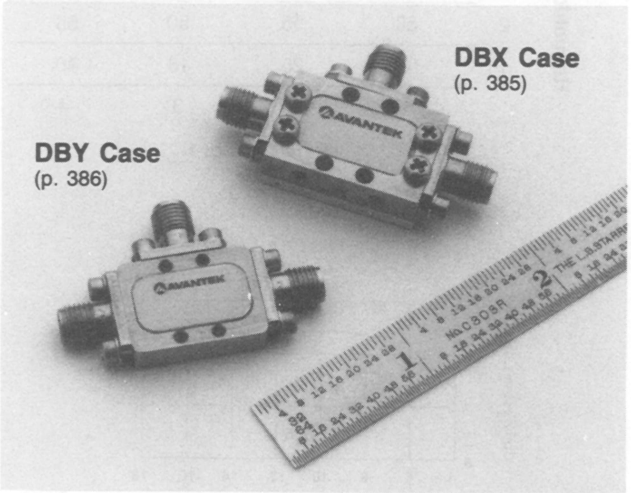
DBX-184LS/MS/HS
DBY-184LS/MS/HS

Avanpak
Double Balanced Mixer
4-18 GHz

AVANTEK

FEATURES

- **30 dB L to I Isolation**
- **30 dB L to R Isolation**
- **Low R Port VSWR**
- **6.0 dB Conversion Loss**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

		Operating Frequencies, GHz			Power Level			Specifications		
Symbol	**Characteristic**	**f_{LO}**	**f_{RF}**	**f_{IF}**	**LO Port dBm**	**Model Suffix**	**RF Port dBm**	**Typical $T_C = 25°C$**	**Guaranteed $T_C = -55°$ to $+100°C$**	**Unit**
BW	Operating Frequency Range	4.0–18.0	4.0–18.0	DC–1.5						GHz
CL	SSB Conversion Loss	6.0–16.0	6.0–16.0	DC–0.5				6.0	7.5	dB max
		4.0–18.0	4.0–18.0	DC–1.0				6.5	8.5	
		4.0–18.0	4.0–18.0	DC–1.5				7.5	9.0	
NF	SSB Noise Figure	6.0–16.0	6.0–16.0	0.03–0.5				6.0	7.5	dB max
		4.0–18.0	4.0–18.0	0.03–1.0				6.5	8.5	
		4.0–18.0	4.0–18.0	0.03–1.5				7.5	9.0	
ISOL	Isolation Port-to-Port L-R	4.0–18.0	—	—				30	20	dB min
	R-L	—	4.0–18.0	—				25	—	
	R-I	—	4.0–9.0	—				30	—	
	R-I	—	9.0–18.0	—				45	—	
	L-I	4.0–18.0	—	—				30	20	
—	VSWR (50 ohm) L	5.0–17.0	—	—				2.0:1		max
	R	—	4.0–5.0	—				3.0:1		
	R	—	5.0–12.0	—				2.0:1		
	R	—	12.0–18.0	—				1.5:1		
	I	—	—	≤1.5				1.5:1		
CC	Conversion Compression Point	4.0–18.0	4.0–18.0	≤1.5	≥ +7	L	0	0.5	1.0	dBm max
		4.0–18.0	4.0–18.0	≤1.5	≥ +10	M	+4			
		4.0–18.0	4.0–18.0	≤1.5	≥ +17	H	+10			
IP_3	Third-Order Two-Tone Intercept Point	4.0–18.0	4.0–18.0	≤1.5	≥ +10	L	—	+9	—	dBm typ
		4.0–18.0	4.0–18.0	≤1.5	+17	M	—	+12	—	
		4.0–18.0	4.0–18.0	≤1.5	≥ +20	H	—	+20	—	
—	LO Port Drive Level	4.0–18.0	4.0–18.0	DC–1.5	+7 to +13	L				dBm
		4.0–18.0	4.0–18.0	DC–1.5	+10 to +17	M				
		4.0–18.0	4.0–18.0	DC–1.5	+17 to +24	H				

MAXIMUM RATINGS

Peak Input Current @ 25°C	100 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	–55°C to +100°C
Storage Temperature	–65°C to +100°C
Continuous RF Input Power	200 mW @ +25°C 100 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

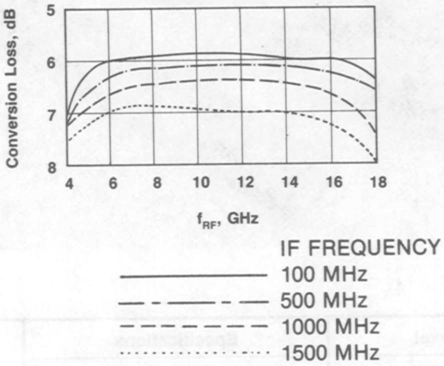
TYPICAL PERFORMANCE AT 25°C

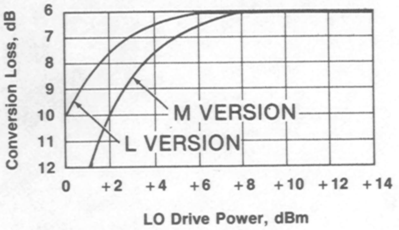
Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

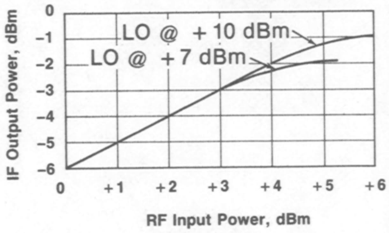
Harmonics of f_{RF}				
4	>70	>70	>70	>70
3	65	>70	55	>70
2	50	55	50	58
1	0	25	18	40
	1	2	3	4
	Harmonics of f_{LO}			

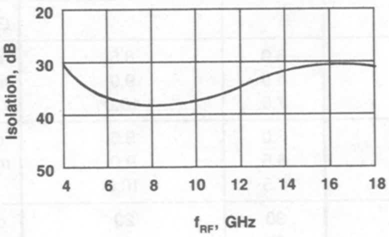
Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at – 10 dBm and f_{LO} signal level of:

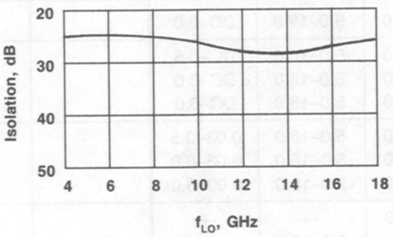
L Suffix .... +7 dBm
M Suffix .... +10 dBm
H Suffix .... +17 dBm

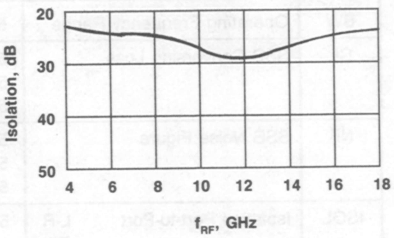

Conversion Loss $f_{LO} < f_{RF}$

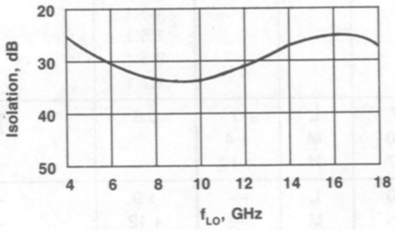

Conversion Loss $f_{LO} = 12$ GHz, $f_{RF} = 12.5$ GHz

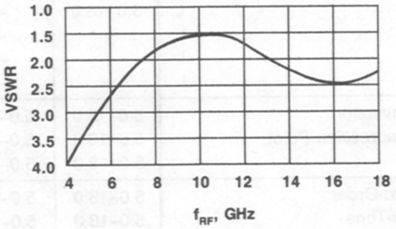

IF Output vs. RF Input Level

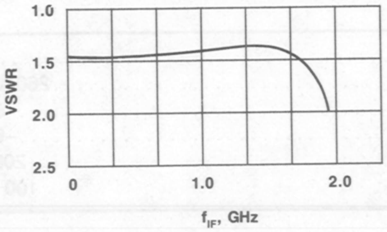

R Port to I Port Isolation

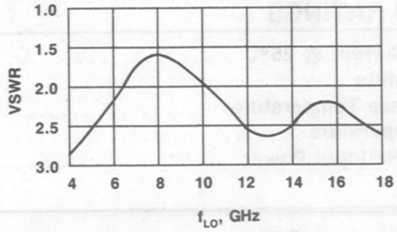

L Port to R Port Isolation


R Port to L Port Isolation


L Port to I Port Isolation


R Port VSWR $f_{IF} = 400$ MHz, $f_{LO} > f_{RF}$


I Port VSWR $f_{LO} = 9$ GHz


L Port VSWR

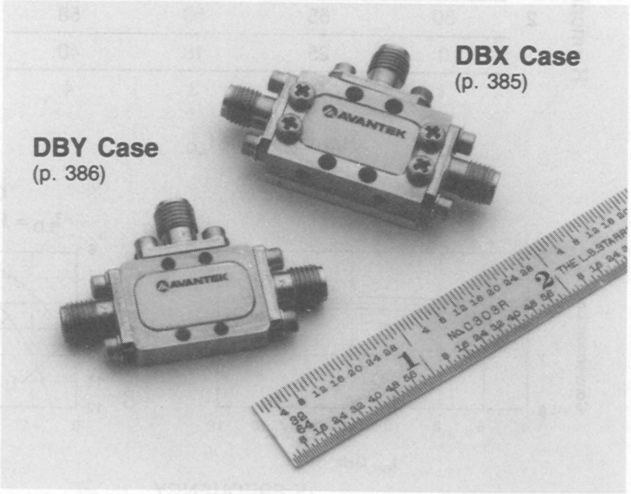
DBX-185L/M/H
DBX-185L/M/H

Avanpak
Double Balanced Mixer
5-18 GHz

AVANTEK

FEATURES

- **DC to 6.0 GHz IF Bandwidth**
- **6.0 dB Conversion Loss**
- **30 dB Isolation**
- **Up to +30 dBm Input Intercept Point**
- **Low VSWR**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic	Operating Frequencies, GHz			Power Level			Specifications		Unit
		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range	5.0–18.0	5.0–18.0	DC–6.0						GHz
CL	SSB Conversion Loss	5.0–18.0	5.0–18.0	DC–0.5				6.0	8.5	dB max
		5.0–16.0	5.0–16.0	DC–6.0				6.5	9.0	
		5.0–18.0	5.0–18.0	DC–6.0				7.5	10.0	
NF	SSB Noise Figure	5.0–18.0	5.0–18.0	0.03–0.5				6.0	8.5	dB max
		5.0–16.0	5.0–16.0	0.03–6.0				6.5	9.0	
		5.0–18.0	5.0–18.0	0.03–6.0				7.5	10.0	
ISOL	Isolation Port-to-Port L-R	5.0–18.0	—	—				30	20	dB min
	R-L	—	5.0–18.0	—				25	—	
	R-I	—	8.0–18.0	—				30	—	
	L-I	5.0–8.5	—	—				10	7	
	L-I	8.5–12.0	—	—				15	12	
	L-I	12.0–18.0	—	—				25	20	
—	VSWR (50 ohm) R	—	5.0–18.0	—				2.0:1		max
	L	5.0–18.0	—	—				1.5:1		
	I	—	—	≤1.0				1.5:1		
	I	—	—	1.0–4.0				2.5:1		
	I	—	—	4.0–6.0				1.7:1		
CC	Conversion Compression Point	5.0–18.0	5.0–18.0	≤6.0	≥ +7	L	0	0.5	1.0	dBm max
		5.0–18.0	5.0–18.0	≤6.0	≥ +10	M	+4			
		5.0–18.0	5.0–18.0	≤6.0	≥ +17	H	+10			
IP_3	Third-Order Two-Tone Intercept Point	5.0–18.0	5.0–18.0	≤6.0	≥ +10	L	—	+9	—	dBm typ
		5.0–18.0	5.0–18.0	≤6.0	+17	M	—	+12	—	
		5.0–18.0	5.0–18.0	≤6.0	≥ +20	H	—	+20	—	
—	LO Port Drive Level	5.0–18.0	5.0–18.0	DC–6.0	+7 to +13	L				dBm
		5.0–18.0	5.0–18.0	DC–6.0	+10 to +17	M				
		5.0–18.0	5.0–18.0	DC–6.0	+17 to +24	H				

MAXIMUM RATINGS

Peak Input Current @ 25°C .... 100 mA DC
Pin Temperature .... 260°C for 10 seconds
Operating Case Temperature .... –55°C to +100°C
Storage Temperature .... –65°C to +100°C
Continuous RF Input Power .... 200 mW @ +25°C
100 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

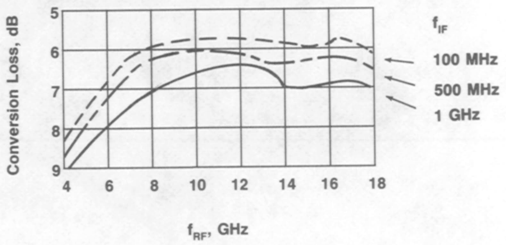
TYPICAL PERFORMANCE AT 25°C

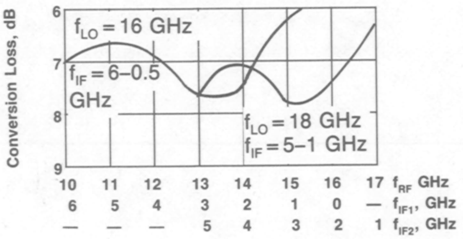
Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

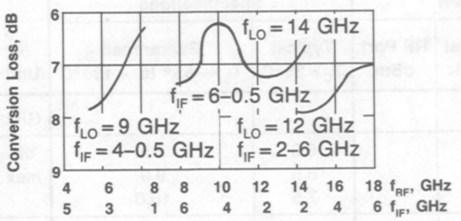
Harmonics of f_{RF}	Harmonics of f_{LO}: 1	2	3	4
4	>70	>70	>70	>70
3	65	>70	55	>70
2	50	55	50	58
1	0	25	18	40

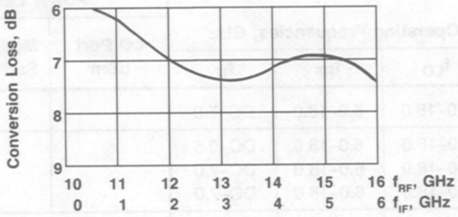
Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at – 10 dBm and f_{LO} signal level of:

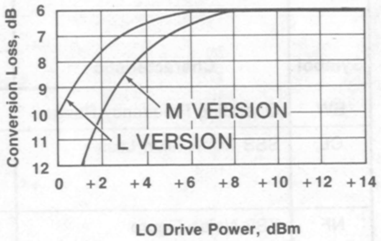
L Suffix . . . . + 7 dBm
M Suffix . . . . + 10 dBm
H Suffix . . . . + 17 dBm

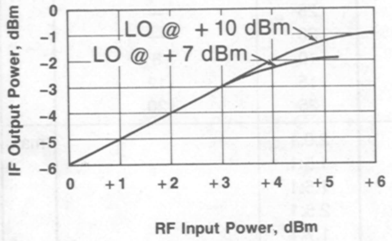

Conversion Loss
$f_{LO} < f_{RF}$

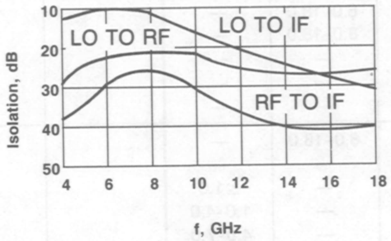

Conversion Loss

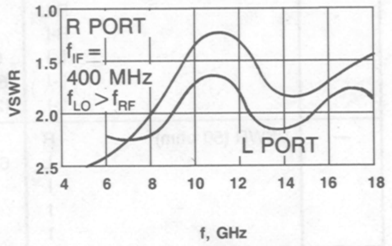

Conversion Loss

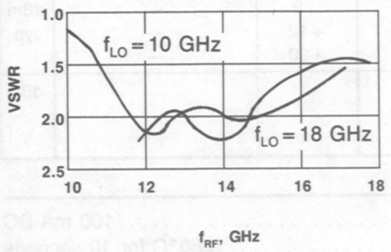

Conversion Loss
f_{LO} = 10 GHz, f_{IF} = 0.5-6 GHz

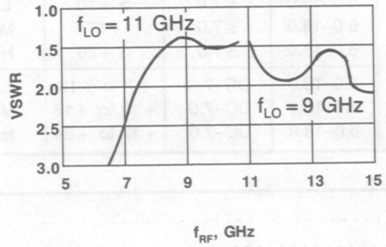

Conversion Loss
f_{LO} = 12 GHz, f_{RF} = 12.5 GHz


IF Output vs. RF Input Level

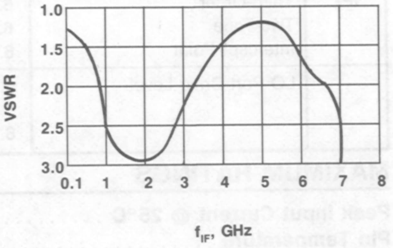

Port-to-Port Isolation


VSWR


R Port VSWR


R Port VSWR

IF Port VSWR
f_{LO} = 12 GHz



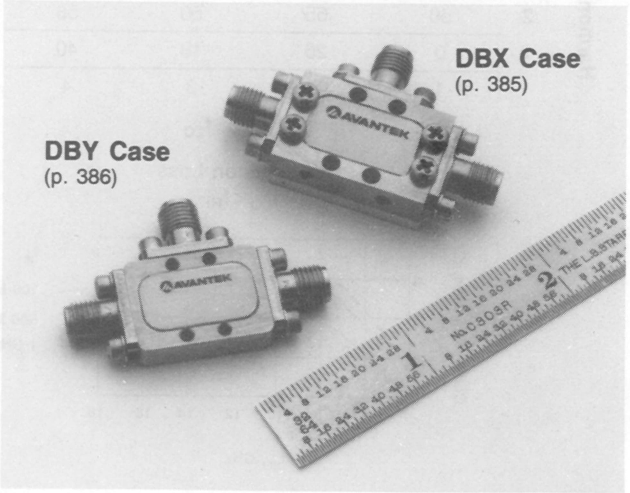
DBX-186L/M/H
DBX-186L/M/H

Avanpak
Double Balanced Mixer
6-18 GHz

AVANTEK

FEATURES

- **DC to 7.0 GHz IF Bandwidth**
- **6.0 dB Conversion Loss**
- **30 dB Isolation**
- **Low VSWR**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic		Operating Frequencies, GHz			Power Level			Specifications		Unit
			f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range		6.0–18.0	6.0–18.0	DC–7.0						GHz
CL	SSB Conversion Loss		6.0–18.0	6.0–18.0	DC–0.5				6.0	8.5	dB max
			6.0–18.0	6.0–18.0	DC–7.0				6.5	9.0	
			6.0–18.0	6.0–18.0	DC–7.0				7.5	10.0	
NF	SSB Noise Figure		6.0–18.0	6.0–18.0	DC–0.5				6.0	8.5	dB max
			6.0–18.0	6.0–18.0	DC–7.0				6.5	9.0	
			6.0–18.0	6.0–18.0	DC–7.5				7.5	10.0	
ISOL	Isolation Port-to-Port	L-R	6.0–16.0	—	—				30	20	dB min
		L-R	16.0–18.0	—	—				22	18	
		R-L	—	6.0–18.0	—				25	—	
		R-I	—	8.0–18.0	—				30	—	
		L-I	6.0–8.0	—	—				10	8	
		L-I	8.0–12.0	—	—				15	12	
		L-I	12.0–18.0	—	—				25	20	
—	VSWR (50 ohm)	R	—	6.0–18.0	—				2.0:1		max
		L	6.0–18.0	—	—				1.5:1		
		I	—	—	≤1.0				1.5:1		
		I	—	—	1.0–4.0				2.5:1		
		I	—	—	4.0–7.0				1.7:1		
CC	Conversion Compression Point		6.0–18.0	6.0–18.0	≤7.0	≥ +7	L	0	0.5	1.0	dBm max
			6.0–18.0	6.0–18.0	≤7.0	≥ +10	M	+4			
			6.0–18.0	6.0–18.0	≤7.0	≥ +17	H	+10			
IP_3	Third-Order Two-Tone Intercept Point		6.0–18.0	6.0–18.0	≤7.0	≥ +10	L	—	+9	—	dBm typ
			6.0–18.0	6.0–18.0	≤7.0	+17	M	—	+12	—	
			6.0–18.0	6.0–18.0	≤7.0	≥ +20	H	—	+20	—	
—	LO Port Drive Level		6.0–18.0	6.0–18.0	DC–7.0	+7 to +13	L				dBm
			6.0–18.0	6.0–18.0	DC–7.0	+10 to +17	M				
			6.0–18.0	6.0–18.0	DC–7.0	+17 to +24	H				

MAXIMUM RATINGS

Peak Input Current @ 25°C .... 100 mA DC
Pin Temperature .... 260°C for 10 seconds
Operating Case Temperature .... −55°C to +100°C
Storage Temperature .... −65°C to +100°C
Continuous RF Input Power .... 200 mW @ +25°C
100 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

TYPICAL PERFORMANCE AT 25°C

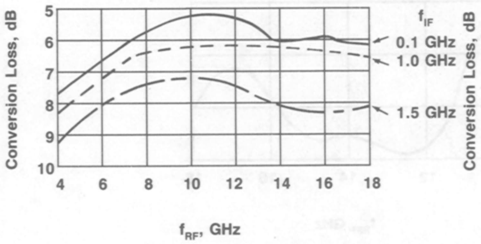
Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

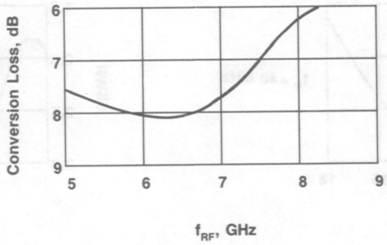
Harmonics of f_{RF}	1	2	3	4	5	6
6	>70	>70	>70	>70	>70	>70
5	>70	>70	>70	>70	>70	>70
4	>70	>70	>70	>70	>70	>70
3	65	>70	55	>70	65	>70
2	50	55	50	58	55	60
1	0	25	18	40	35	45

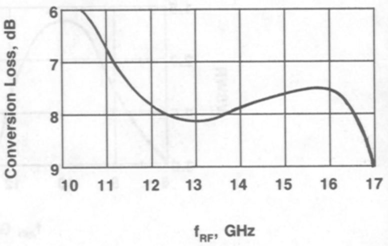
Harmonics of f_{LO}

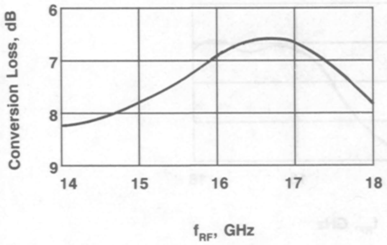
Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at − 10 dBm and f_{LO} signal level of:

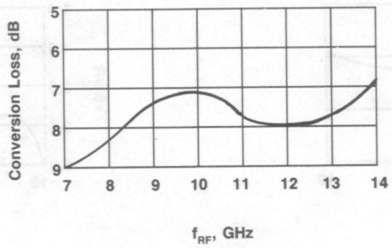
L Suffix .... + 7 dBm
M Suffix .... + 10 dBm
H Suffix .... + 17 dBm

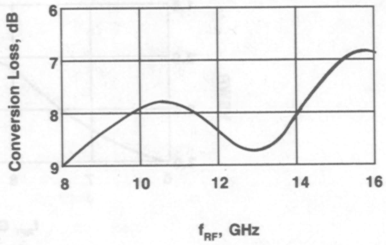

Conversion Loss $f_{LO}<f_{RF}$

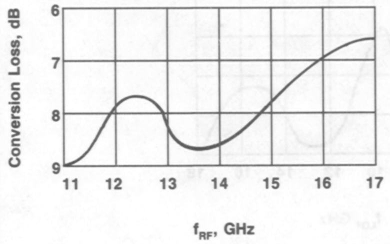

Conversion Loss $f_{LO}=9$ GHz, $f_{IF}=4$ GHz-0.5 GHz

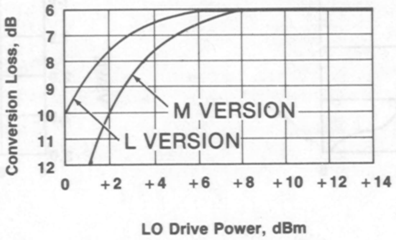

Conversion Loss $f_{LO}=10$ GHz, $f_{IF}=0.5$-7.0 GHz

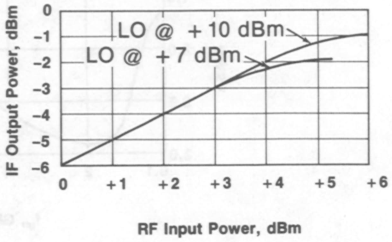

Conversion Loss $f_{LO}=12$ GHz, $f_{IF}=2$-6 GHz

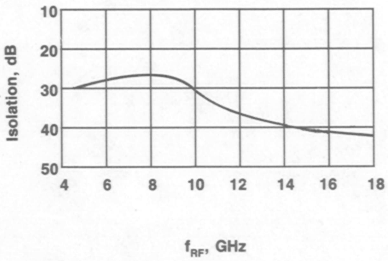

Conversion Loss $f_{LO}=14$ GHz, $f_{IF}=7.0$-0.5 GHz

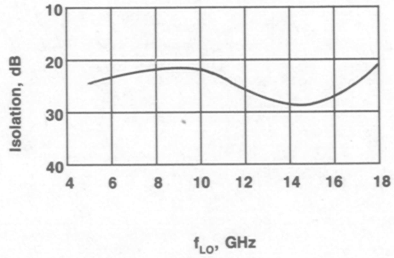

Conversion Loss $f_{LO}=16$ GHz, $f_{IF}=7.0$-0.5 GHz

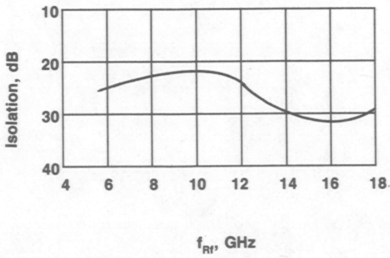

Conversion Loss $f_{LO}=18$ GHz, $f_{IF}=7.0$-0.5 GHz


Conversion Loss $f_{LO}=12$ GHz, $f_{RF}=12.5$ GHz


IF Output vs. RF Input Level

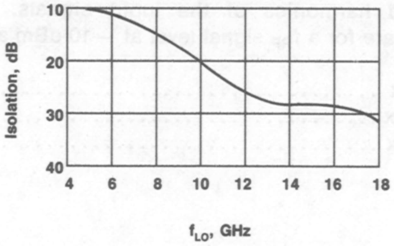

R Port to I Port Isolation


L Port to R Port Isolation

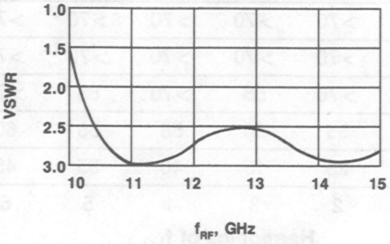

R Port to L Port Isolation

TYPICAL PERFORMANCE AT 25°C (continued)

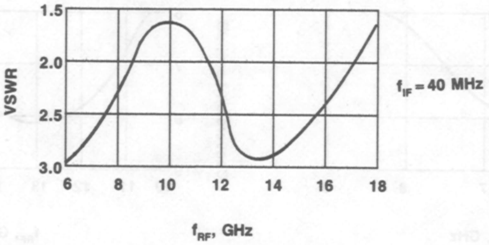
L Port to I Port Isolation



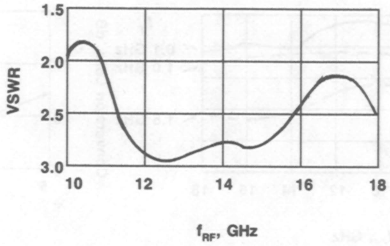
R Port VSWR
f_{LO} = 9 GHz



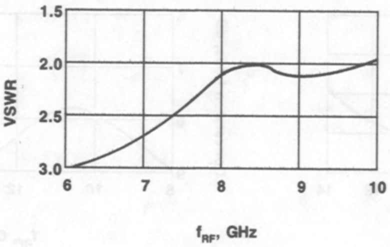
R Port VSWR
f_{IF} = 400 MHz, $f_{LO} > f_{RF}$



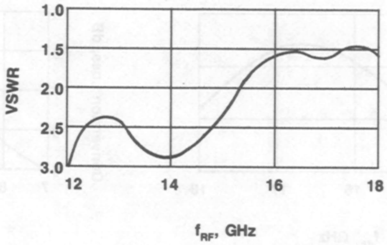
R Port VSWR
f_{LO} = 10 GHz



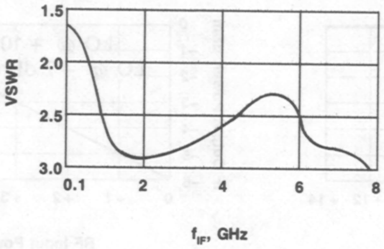
R Port VSWR
f_{LO} = 11 GHz



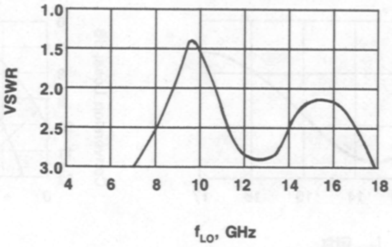
R Port VSWR
f_{LO} = 18 GHz



I Port VSWR
f_{LO} = 12 GHz



L Port VSWR



NOTES:

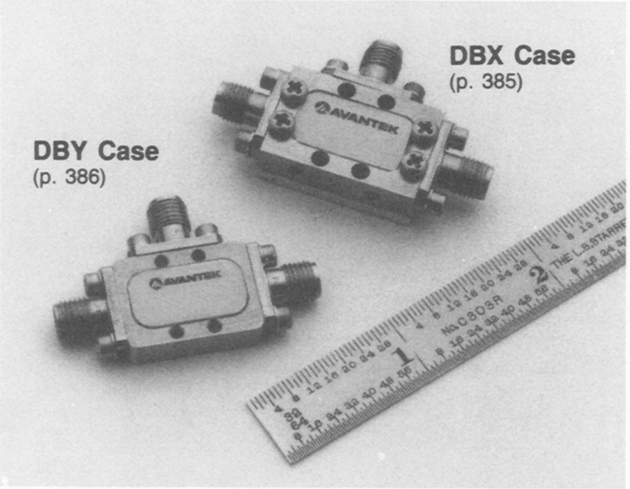
DBX-824M/H
DBY-824M/H

Avanpak
Double Balanced Mixer
2.0-8.0 GHz

AVANTEK

FEATURES

- **.005 to 4.0 GHz IF Bandwidth**
- **Up to +32.0 dBm Input Intercept Point**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic	Operating Frequencies, GHz			Power Level			Specifications		Unit
		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range	2.0–8.0	2.0–8.0	.005–4.0						GHz
CL	SSB Conversion Loss	2.0–8.0	2.0–8.0	0.005–1.5				6.0	8.0	dB
		2.0–8.0	2.0–8.0	0.005–4.0				6.5	8.5	max
NF	SSB Noise Figure	2.0–8.0	2.0–8.0	0.005–1.5				6.0	8.0	dB
		2.0–8.0	2.0–8.0	0.03–4.0				6.5	8.5	max
ISOL	Isolation Port-to-Port L-R	2.0–4.0	—	—				20	15	dB
	L-R	4.0–8.0	—	—				25	20	min
	R-L	—	2.0–8.0	—				25	—	
	R-I	—	2.0–8.0	—				25	—	
	L-I	2.0–8.0	—	—				30	20	
	I-R	—	—	0.005–4.0				30	—	
	I-L	—	—	0.005–4.0				30	—	
—	VSWR (50 ohm) (large signal) L	2.0–8.0	—	—				1.5:1		max
	(small signal) R	—	2.0–4.0	—				2.5:1		
	(small signal) R	—	4.0–8.0	—				2.0:1		
	(large signal) R	—	2.0–8.0	—				2.0:1		
	(large signal) I	—	—	0.005–4.0				1.5:1		
	(small signal) I	—	—	0.005–4.0				1.5:1		
CC	Conversion Compression Point	2.0–8.0	2.0–8.0	0.005–4.0	+10	M	+4	0.5	1.0	dBm
		2.0–8.0	2.0–8.0	0.005–4.0	+13	H	+6	0.5	1.0	max
IP_3	Third-Order Two-Tone Intercept Point	2.0–8.0	2.0–8.0	0.005–4.0	≥ +13	M	—	+15	—	dBm
		2.0–8.0	2.0–8.0	0.005–4.0	≥ +17	H	—	+18	—	typ
—	LO Port Drive Level	2.0–8.0	2.0–8.0	.005–4.0	+10 to +17	M				dBm
		2.0–8.0	2.0–8.0	.005–4.0	+13 to +20	H				

MAXIMUM RATINGS

Peak Input Current @ 25°C	200 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	–55°C to +100°C
Storage Temperature	–65°C to +100°C
Continuous RF Input Power	400 mW @ +25°C 200 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

TYPICAL PERFORMANCE AT 25°C

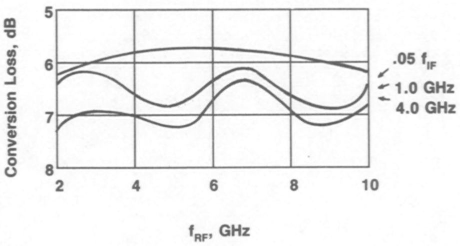
Harmonics of f_{RF}						
6	>70	>70	>70	>70	>70	>70
5	>70	>70	>70	>70	>70	>70
4	>70	>70	>70	>70	>70	>70
3	65	>70	60	>70	65	>70
2	55	55	55	58	55	60
1	0	35	18	40	35	45
	1	2	3	4	5	6

Harmonics of f_{LO}

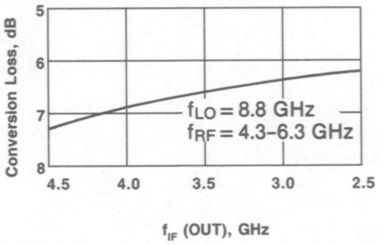
Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at – 10 dBm and f_{LO} signal level of:

M Suffix . . . . + 10 dBm
H Suffix . . . . + 13 dBm

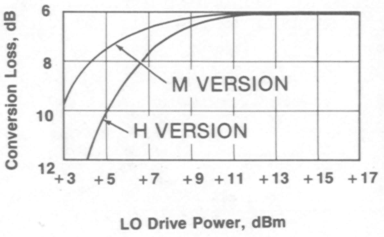
Conversion Loss
$f_{LO} < f_{RF}$



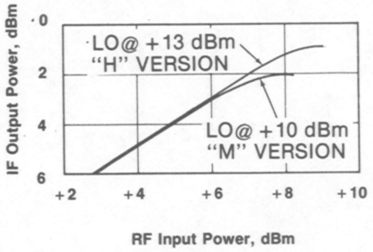
Conversion Loss



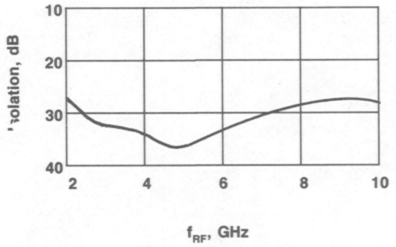
Conversion Loss
f_{LO} = 6 GHz, f_{RF} = 8 GHz



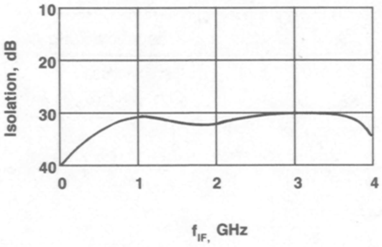
IF Output vs. RF Input Level



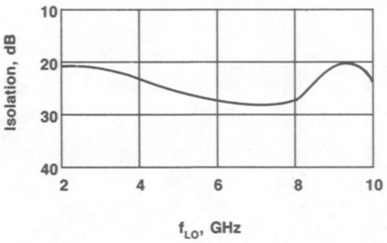
R Port to I Port Isolation



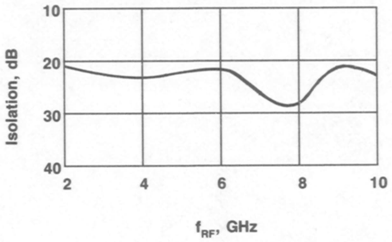
I Port to R Port Isolation



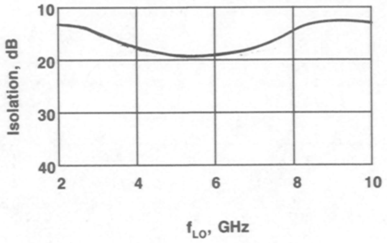
L Port to R Port Isolation



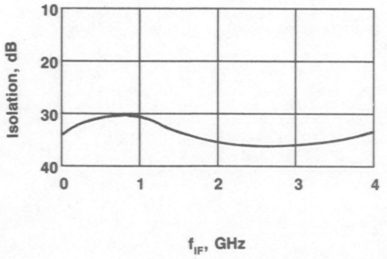
R Port to L Port Isolation



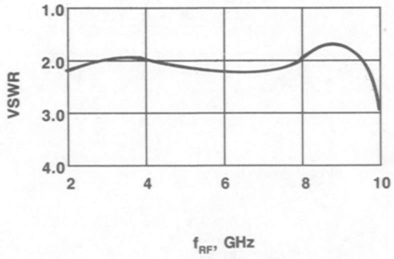
L Port to I Port Isolation



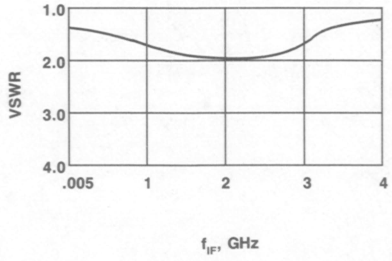
I Port to L Port Isolation



R Port VSWR

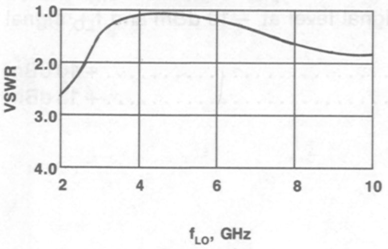


I Port VSWR

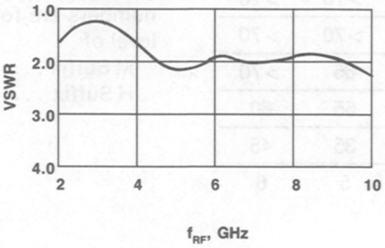


TYPICAL PERFORMANCE AT 25°C (continued)

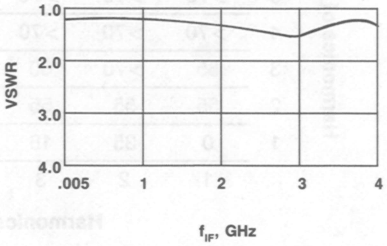
L Port VSWR (Large Signal)



R Port VSWR (Large Signal)



I Port VSWR (Large Signal)



NOTES:

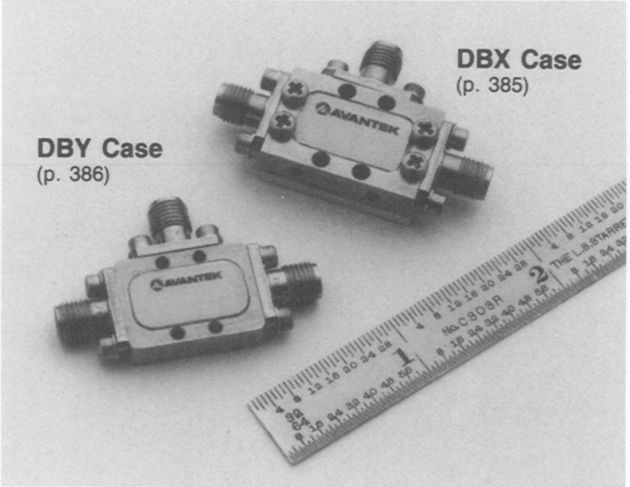
DBX-1221L/M/H
DBY-1221L/M/H

Avanpak
Double Balanced Mixer
2-12 GHz

AVANTEK

FEATURES

- **5.5 dB Conversion Loss**
- **40 dB Isolation**
- **Low VSWR**
- **Up to +30 dBm Input Intercept Point**



ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic	Operating Frequencies, GHz			Power Level			Specifications		Unit
		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range	2.0–12.0	2.0–12.0	DC–1.3						GHz
CL	SSB Conversion Loss	3.0–10.0	3.0–10.0	DC–0.5				5.5	7.5	dB max
		2.0–12.0	2.0–12.0	DC–1.3				6.5	8.5	
NF	SSB Noise Figure	3.0–10.0	3.0–10.0	0.03–0.5				5.5	7.5	dB max
		2.0–12.0	2.0–12.0	0.03–1.3				6.5	8.5	
ISOL	Isolation Port-to-Port L-R	2.0–12.0	—	—				35	25	dB min
	R-L	—	2.0–12.0	—				35	—	
	R-I	—	2.0–12.0	—				20	—	
	L-I	3.0–12.0	—	—				25	20	
	L-I	2.0–3.0	—	—				20	18	
—	VSWR (50 ohm) L	3.0–12.0	—	—				1.5:1		max
	L	2.0–12.0	—	—				2.0:1		
	R	—	4.0–10.0	—				1.5:1		
	R	—	2.0–12.0	—				2.5:1		
	I	—	—	≤1.3				1.5:1		
CC	Conversion Compression Point	2.0–12.0	2.0–12.0	≤1.3	≥+7	L	0	0.5	1.0	dBm max
		2.0–12.0	2.0–12.0	≤1.3	≥+10	M	+4			
		2.0–12.0	2.0–12.0	≤1.3	≥+17	H	+10			
IP_3	Third-Order Two-Tone Intercept Point	2.0–12.0	2.0–12.0	≤1.3	≥+10	L	—	+9	—	dBm typ
		2.0–12.0	2.0–12.0	≤1.3	+17	M	—	+12	—	
		2.0–12.0	2.0–12.0	≤1.3	≥+20	H	—	+20	—	
—	LO Port Drive Level	2.0–12.0	2.0–12.0	DC–1.3	+7 to +13	L				dBm
		2.0–12.0	2.0–12.0	DC–1.3	+10 to +17	M				
		2.0–12.0	2.0–12.0	DC–1.3	+17 to +24	H				

MAXIMUM RATINGS

Peak Input Current @ 25°C	100 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	–55°C to +100°C
Storage Temperature	–65°C to +100°C
Continuous RF Input Power	200 mW @ +25°C 100 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

TYPICAL PERFORMANCE AT 25°C

Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

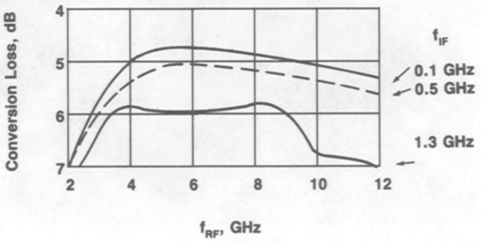
Harmonics of f_{RF}	1	2	3	4
4	>70	>70	>70	>70
3	65	>70	55	>70
2	50	55	50	58
1	0	25	18	40

Harmonics of f_{LO}

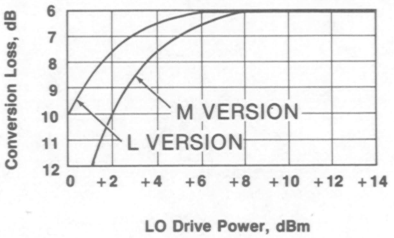
Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at – 10 dBm and f_{LO} signal level of:

L Suffix . . . . + 7 dBm
M Suffix . . . . + 10 dBm
H Suffix . . . . + 17 dBm

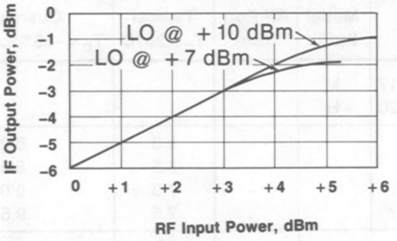
Conversion Loss
$f_{LO} < f_{RF}$



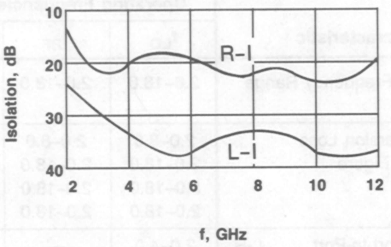
Conversion Loss
$f_{LO} = 12$ GHz, $f_{RF} = 12.5$ GHz



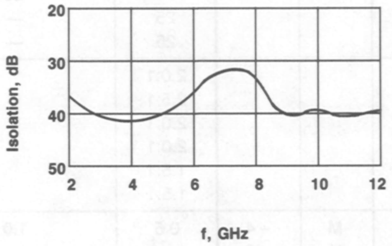
IF Output vs. RF Input Level



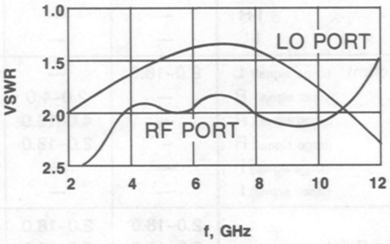
Port to Port Isolation



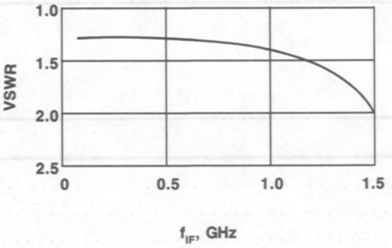
L Port to R Port Isolation



VSWR
$f_{LO} > f_{IF} = 0.5$ GHz



I Port VSWR
$f_{LO} = 9$ GHz



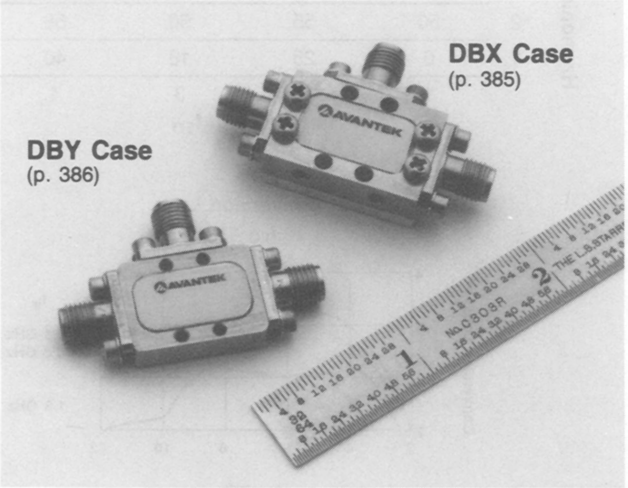
DBX-1824M/H
DBY-1824M/H

Avanpak
Double Balanced Mixer
2.0-18.0 GHz

AVANTEK

FEATURES

- **7 dB Conversion Loss/Noise Figure**
- **.005 to 4 GHz IF Bandwidth**
- **2.0 to 18 GHz RF Bandwidth**



DBX Case
(p. 385)

DBY Case
(p. 386)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic	Operating Frequencies, GHz			Power Level			Specifications		Unit
		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range	2.0–18.0	2.0–18.0	.005–4.0	+10 to +17 +13 to +20	M H				GHz
CL,NF	SSB Conversion Loss and Noise Figure	2.0–8.0	2.0–8.0	0.005–1.5				6.0	8.0	dB max
		2.0–18.0	2.0–18.0	0.005–1.5				6.5	8.5	
		2.0–18.0	2.0–18.0	0.005–2.5				7.0	9.0	
		2.0–18.0	2.0–18.0	0.005–4.0				7.5	9.5	
ISOL	Isolation Port-to-Port L-R	2.0–4.0	—	—				20	15	dB min
	L-R	4.0–18.0	—	—				25	20	
	R-L	—	2.0–18.0	—				25	—	
	R-I	—	2.0–18.0	—				25	—	
	L-I	2.0–18.0	—	—				30	20	
	I-R	—	—	0.005–8.0				25	—	
	I-L	—	—	0.005–8.0				25	—	
—	VSWR (50 ohm) (large signal) L	2.0–18.0	—	—				2.0:1		max
	(small signal) R	—	2.0–4.0	—				2.5:1		
	(small signal) R	—	4.0–18.0	—				2.0:1		
	(large signal) R	—	2.0–18.0	—				2.0:1		
	(large signal) I	—	—	0.005–8.0				1.5:1		
	(small signal) I	—	—	0.005–8.0				1.5:1		
CC	Conversion Compression Point	2.0–18.0 2.0–18.0	2.0–18.0 2.0–18.0	0.005–4.0 0.005–4.0	+10 +13	M H	+4 +6	0.5	1.0	dBm max
IP_3	Third-Order Two-Tone Input Intercept Point	2.0–18.0 2.0–18.0	2.0–18.0 2.0–18.0	0.005–4.0 0.005–4.0	≥ +13 ≥ +17	M H	— —	+15 +18	— —	dBm typ

MAXIMUM RATINGS

Peak Input Current @ 25°C	200 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	–55°C to +100°C
Storage Temperature	–65°C to +100°C
Continuous RF Input Power	400 mW @ +25°C 200 mW @ +100°C

WEIGHT: (typical) DBX — 22 grams; DBY — 16 grams

TYPICAL PERFORMANCE AT 25°C

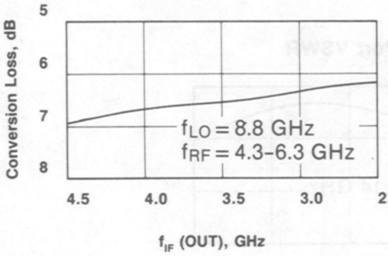
Typical Single Tone Intermodulation Harmonic Suppression at 25°C (dB below desired output)

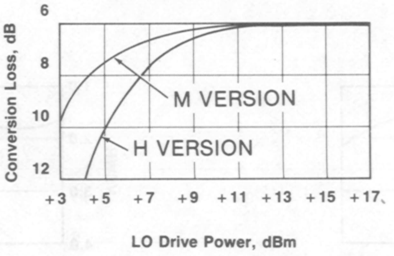
Harmonics of f_{RF}						
6	>70	>70	>70	>70	>70	>70
5	>70	>70	>70	>70	>70	>70
4	>70	>70	>70	>70	>70	>70
3	65	>70	60	>70	65	>70
2	55	55	55	58	55	60
1	0	35	18	40	35	45
	1	2	3	4	5	6

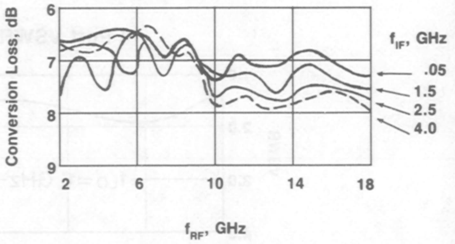
Harmonics of f_{LO}

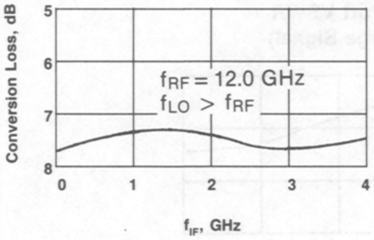
Typical Harmonic Intermodulation Suppression for mixer generated harmonics of the input signals. Suppression numbers are for a f_{RF} signal level at − 10 dBm and f_{LO} signal level of:

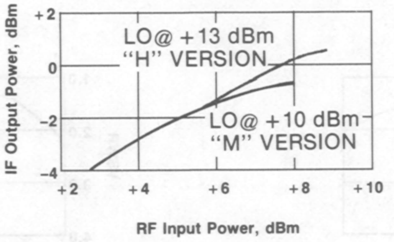
M Suffix .... + 10 dBm
H Suffix .... + 13 dBm

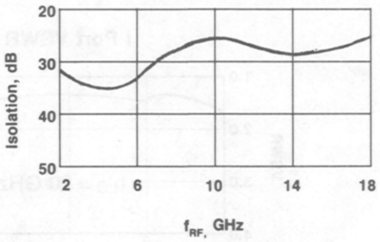

Conversion Loss

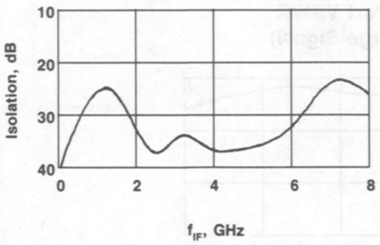

Conversion Loss
f_{LO} = 6 GHz, f_{RF} = 8 GHz

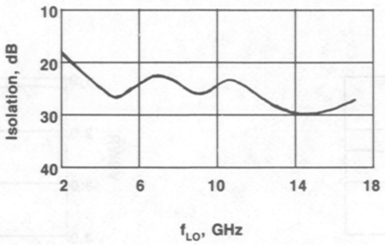

Conversion Loss

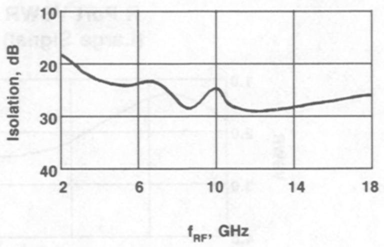

Conversion Loss

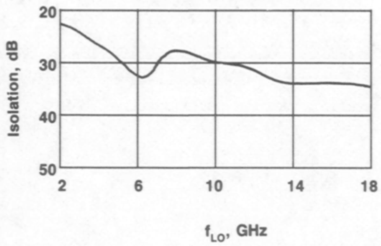

IF Output vs. RF Input Level

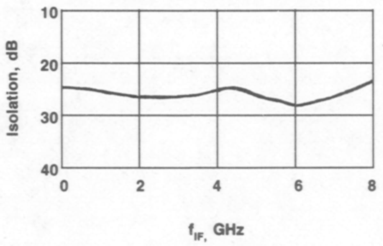

R Port to I Port Isolation

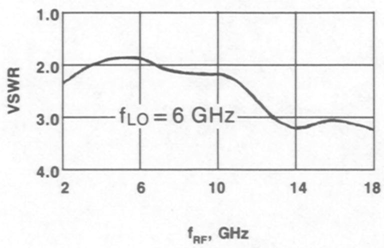

I Port to R Port Isolation


L Port to R Port Isolation


R Port to L Port Isolation

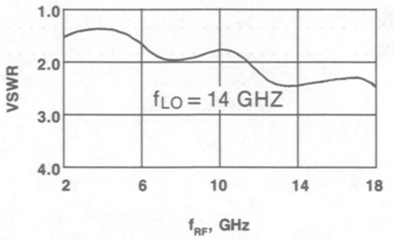

L Port to I Port Isolation


I Port to L Port Isolation

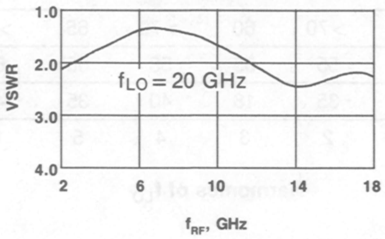

R Port VSWR

TYPICAL PERFORMANCE AT 25°C (continued)

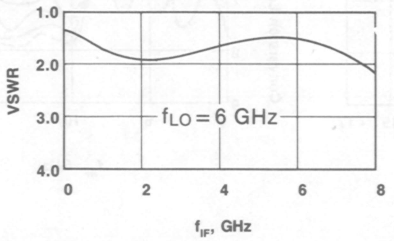
R Port VSWR



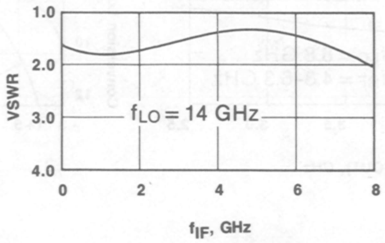
R Port VSWR



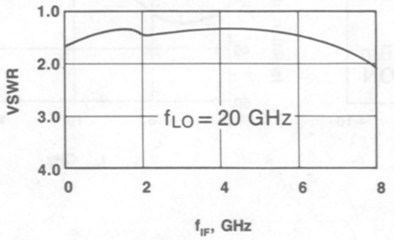
I Port VSWR



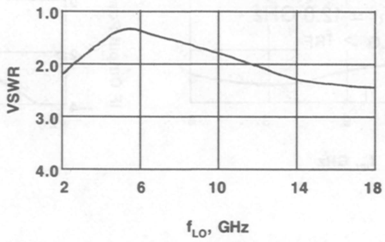
I Port VSWR



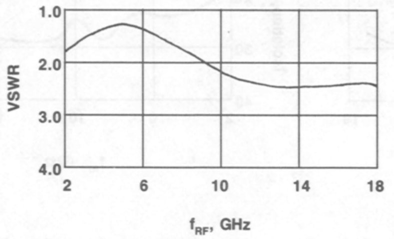
I Port VSWR



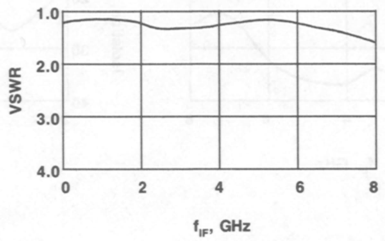
L Port VSWR (Large Signal)



R Port VSWR (Large Signal)



I Port VSWR (Large Signal)



NOTES:

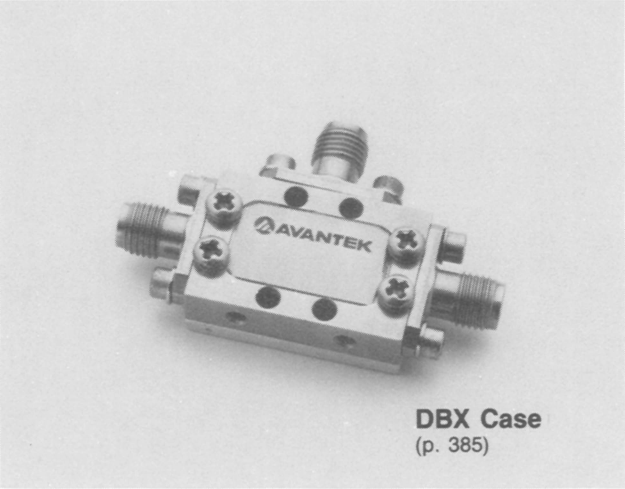
DBX-3503M/H

Avanpak
Double Balanced Mixer
.05-3.0 GHz

AVANTEK

FEATURES

- **50 MHz-3 GHz RF and LO Bandwidth**
- **1 MHz-3 GHz IF Bandwidth**
- **7 dB Typ. Conversion Loss/NF**
- **30 dB Typ. Port-to-Port Isolation**
- **Low VSWR All Ports, Typically <2.0:1**
- **Up to +18 dBm Input Intercept Point**
- **Avanpak™ "Universal" Package**


DBX Case
(p. 385)

ELECTRICAL SPECIFICATIONS (Measured in a 50-ohm system)

Symbol	Characteristic	Operating Frequencies, GHz			Power Level			Specifications		Unit
		f_{LO}	f_{RF}	f_{IF}	LO Port dBm	Model Suffix	RF Port dBm	Typical $T_C = 25°C$	Guaranteed $T_C = -55°$ to $+100°C$	
BW	Operating Frequency Range	.05–3.5	.05–3.0	.001–3.0	+10 to +17 +13 to +20	M H				GHz
CL, NF	SSB Conversion Loss and Noise Figure	0.2–1.5	0.2–1.0	0.001–0.5				6.8	7.5	dB max
		0.05–1.5	0.05–1.0	0.001–0.5				7.0	8.0	
		0.05–3.5	0.05–3.0	0.001–0.5				7.4	8.4	
		0.05–3.5	0.05–3.0	0.001–1.5				8.0	—	
		0.05–3.5	0.05–3.0	0.001–3.0				8.5	—	
ISOL	Isolation Port-to-Port L-R	0.25–1.5	—	—				34	28	dB min
	L-R	0.05–1.5	—	—				30	26	
	L-R	0.05–3.5	—	—				24	20	
	L-I	0.05–3.5	—	—				35	30	
	R-I	0.05–3.5	1.0–3.0	—				30	24	
	R-I	0.05–3.5	0.05–3.0	—				26	22	
—	VSWR (50 ohm) L	0.05–1.5	—	—				1.8:1		
	L	0.05–3.5	—	—				2.5:1		
	R	0.05–3.5	0.05–1.0	—				1.7:1		
	R	0.05–3.5	0.05–3.0	—				2.3:1		
	I	0.05–3.5	—	0.001–1.0				1.8:1		
	I	0.05–3.5	—	0.001–3.0				2.2:1		
CC	Conversion Compression Point	—	dB~~m~~	—	≥ +10 ≥ +15	M H	+4 +6		0.5	1.0 max
IP_3	Third-Order Two-Tone Intercept Point	0.06	0.05	0.01	+10		−10	+18	—	dBm typ
		0.11	0.10	0.01	+10		−10	+20	—	
		0.30	0.25	0.05	+10		−10	+20	—	
		0.60	0.50	0.10	+10		−10	+19		
		1.10	1.00	0.10	+10		−10	+20		
		2.50	2.00	0.50	+10		−10	+16		
		3.50	3.00	0.50				+17		

MAXIMUM RATINGS

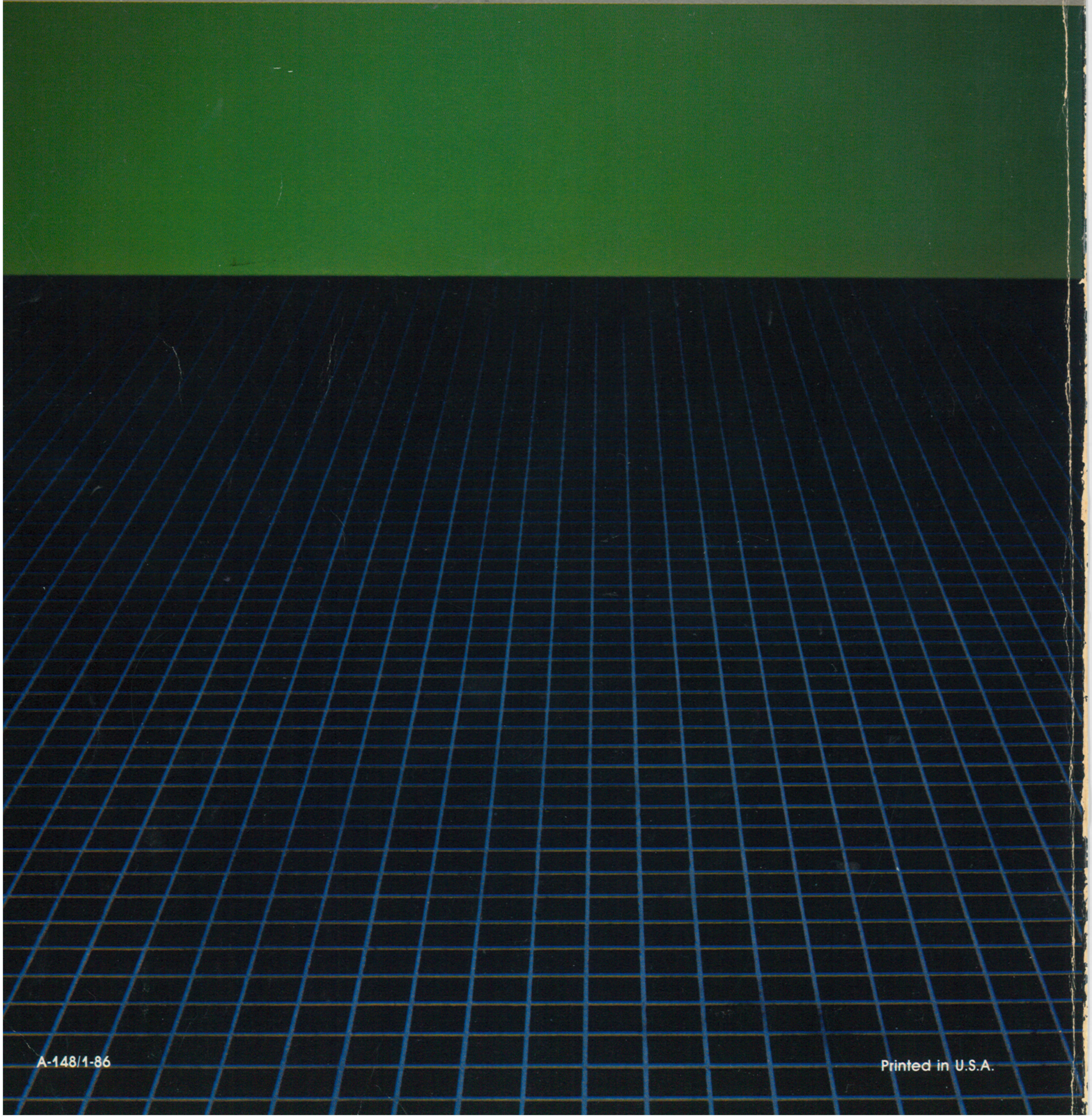
Peak Input Current @ 25°C	100 mA DC
Pin Temperature	260°C for 10 seconds
Operating Case Temperature	-55°C to +100°C
Storage Temperature	-62°C to +100°C
Continuous RF Input Power	200 mW @ +25°C 100 mW @ +100°C

WEIGHT: (typical) DBX—22 grams

AVANTEK

3175 Bowers Avenue
Santa Clara, California 95054-3292
Phone (408) 727-0700

Product Guide • Amplifier Product Data Book • Signal Sources and Filters Data Book
Semiconductor Devices Data Book • Subassembly Capabilities Guide



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